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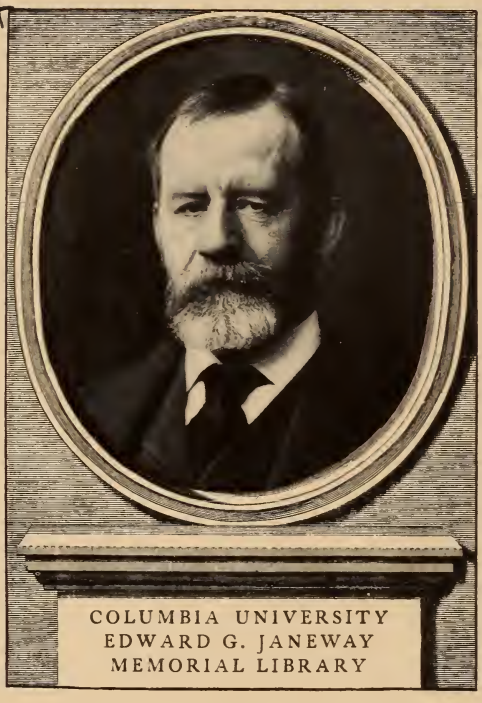

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TRANSACTIONS

OF THE

~~SEVENTH ANNUAL MEETING~~

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION,

HELD AT

DENVER, COL.,

SEPTEMBER 2, 3, AND 4, 1890.

THE SANITARIAN PRINT:
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1891.

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1890.

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VAN BIBBER, W. C., 47 Franklin Street, Baltimore.
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WILLIAMS, H. F., 450 Classon Avenue, Brooklyn.
WILSON, H. M., JR., Masonic Temple, Denver.
WILSON, JAMES C., 1437 Walnut Street, Philadelphia.
WROTH, JAMES H., Albuquerque, N. M.

MINUTES.

THE seventh annual meeting of the American Climatological Association was held in Denver, September 2d, 3d, and 4th, 1890.

Thirty-seven members and visitors signed the register of attendance.

The President, Dr. Charles Denison, occupied the chair.

The papers which appear in this volume were presented to the Association by their authors, excepting a few which in the author's absence were read by title.

The President appointed the following Committee on Nomination of Officers: Drs. Ingals, Curtin, Fisk, Solly, and Baker.

The session for private business was called to order on Thursday, September 4th, Dr. Denison, President, in the chair.

The minutes of the last meeting were read and approved.

The Treasurer's report was read and Drs. Bowditch and Ingals were appointed an auditing committee, who reported the account correct, with a balance in the treasury of twenty-two dollars and twenty-eight cents ($22.28).

Under the head of unfinished business the Secretary called attention to a resolution introduced by him at the last meeting to separate the offices of Secretary and Treasurer. On motion of Dr. Knight it was laid on the table.

The Council presented their report with the list of nominations for membership, and on motion of Dr. Knight each name was voted upon separately, resulting in the election of the following:

HONORARY MEMBERS.

Dr. Alfred Stillé, Philadelphia.
Dr. H. C. Lombard, Geneva, Switzerland.

ACTIVE MEMBERS.

Dr. E. J. A. Rogers, Denver.
Dr. J. C. Mulhall, St. Louis.
Dr. J. J. Buckley, Missoula, Mont.
Dr. Harrison Allen, Philadelphia.
Dr. W. D. Robinson, Philadelphia.
Dr. A. Alexander Smith, New York.
Dr. R. P. Lincoln, New York.
Dr. E. G. Janeway, New York.
Dr. H. B. Millard, New York.
Dr. J. H. Kellogg, Battle Creek, Mich.
Dr. Charles P. Donaldson, Muskegon, Mich.
Dr. Thomas J. Darlington, Bisbee, Arizona.
Dr. Walter E. Fisher, San Francisco.
Dr. James H. Wroth, Albuquerque, N. M.
Dr. George W. Foster, Salt Lake City.
Dr. A. C. Standart, Salt Lake City.
Dr. Francis H. Atkins, Las Vegas, N. M.
Dr. H. O. Dodge, Boulder, Col.
Dr. Jacob Reed, Colorado Springs.
Dr. B. P. Anderson, Colorado Springs.
Dr. John A. Robinson, Chicago.

The Council recommended that the Constitution be so amended as to include a grade of corresponding members. Laid over for action at next meeting.

The President announced that the next meeting of the Association would be held in Washington in conjunction with the Congress of American Physicians and Surgeons.

The Nominating Committee made the following report for officers for the ensuing year :

President, Dr. Frederick I. Knight, Boston.
Vice-Presidents, Dr. E. L. Trudeau, Saranac Lake.
Dr. T. S. Hopkins, Thomasville.
Secretary and Treasurer, Dr. J. B. Walker, Philadelphia.
Council, Dr. A. L. Loomis,
Dr. E. L. Shurley.

On motion of Dr. Ingals, the Secretary was directed to cast a ballot for the officers as presented, and they were declared elected.

After some discussion as to the best method of publishing

our volume of transactions, it was decided to allow each member to publish his paper in such journal as he may select, and furnish the Secretary a copy thereof within one month of this date. That the Secretary have the volume published to the best advantage of the Association.

On motion of Dr. Solly, the question of limiting the number of membership in the Association was referred to Councils for consideration, they to report at the next meeting.

Dr. Baker moved that a vote of thanks be tendered *Mr. and Mrs. C. B. Kountze*, the Colorado members, and the profession of the city of Denver, the local Committee on Entertainment, the Union Pacific R. R., the Denver and Rio Grande R. R., the Colorado Midland R. R., the city of Denver, the county of Arapahoe, and the Denver daily papers, and to others for the courtesies extended to the Association and its guests.

Dr. Curtin offered the following :

Resolved, That in consideration of the number of lepers in various parts of our country, whose management and control is a continual and increasing problem of difficult solution to the local authorities, we appoint a committee to memorialize Congress in the interests of the establishment of a leper colony in some safe portion of the territory of the United States, to which all suffering from leprosy may be sent.

The motion was carried, and the chair appointed Dr. Curtin a committee to carry out the purpose of the resolution.

On motion of Dr. Curtin it was resolved that our representative and President be empowered to communicate with the Executive Committee of the Congress of American Physicians and Surgeons in an endeavor to reduce the taxes to our organization for the expenses of the approaching Congress.

Then adjourned.

J. B. WALKER,
Secretary.

On Friday a complimentary excursion, given by the Union Pacific Railway, to Idaho Springs and return through Clear Creek Cañon was much enjoyed.

On Saturday we started on a similar excursion, given by the Denver and Rio Grande Railway around the Circle, through Puebla, Veta Pass, spending the first night at Durango, thence

via the cañon of the River of Lost Souls to Ouray for the second night, and thence *via* the Black Cañon of the Gunnison, over Marshall Pass, through the Grand Cañon of the Arkansas and back to Colorado Springs.

Here two delightful days were spent as the guests of The El Paso County Medical Society, and in a visit to Manitou and the interesting points adjacent.

The Colorado Midland Railway placed at the disposal of our members a complimentary excursion, embracing two days, to Glenwood Springs *via* Leadville and return, which proved enjoyable to those who were able to stay for it.

OFFICERS OF THE ASSOCIATION,

1891.

President:

FREDERICK I. KNIGHT, M.D., Boston.

Vice-Presidents:

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T. S. HOPKINS, M.D., Thomasville.

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CONTENTS.

Officers ..... v.
List of Members ..... vii.
Minutes ..... x.
Welcoming Address. Charles Denison, A.M., M.D., President 1
Abnormal Intra-Thoracic Air Pressures and their Treatment. Charles Denison, A.M., M.D 10
Pneumatic Treatment of Disease, with Cases. D. M. Cammann, M.D 47
Graphic Method of Recording Diseased Conditions of the Lungs, and a New Form of Pneumograph. J. H. Kellogg, M.D 57
Discussion. Drs. V. Y. Bowditch, J. H. Kellogg, E. Fletcher Ingals, S. E. Solly, Francis H. Atkins 69
The Climate of the Great Salt Lake Basin. A. C. Standart 72
The Preferable Attributes of Climate for Consumption, as Applied to the Winters in Southern New Mexico, Southern Arizona, and Western Texas. W. M. Yandall, M.D 81
Discussion. Drs. F. I. Knight, E. Fletcher Ingals, W. M. Yandall, S. E. Solly, H. B. Baker 94
Is Herpes Zoster a Cause of Pleurisy and Peritonitis? Roland G. Curtin, M.D., Ph.D 101
Requisites for a Closed Sanitarium in Colorado. J. H. Kellogg, M.D 107
Discussion. Drs. Bowditch, Solly, Kellogg, Denison 124
The Thermal Springs of Salt Lake City. George W. Foster, M.D. 128
Treatment of Pulmonary Consumption by Residence in Colorado, as Exemplified by the Analysis of 141 Cases. S. E. Solly, M.D., F.R.C.S 132
Discussion. Drs. Knight, Ingals, Solly, Fisk, Bowditch, Curtin, Denison. 158
Nervous and Mental Diseases Observed in Colorado. J. T. Eskridge, M.D 163
Discussion. Drs. Solly, Denison, Eskridge 181
Acclimation of the Consumptive to the Climate of Colorado. H. O. Dodge, M.D 183
Discussion. Drs. Ingals and Dodge 188
On the Return of Cured Tubercular Patients from High Altitudes. F. I. Knight, M.D 189
Discussion. Drs. Solly, Bowditch, Fisk, Rogers, Eskridge, Bancroft, Pitner, Denison, Knight 196
Relation of Certain Meteorological Conditions to Diseases of the Lungs and Air Passages in Colorado. H. B. Baker, A.M., M.D 210
Discussion. Drs. Ingals, Denison, Solly, Baker 231

Some Notes on New Mexico and the Adjacent Plains. Francis H. Atkins, S.B., M.D. 239
Discussion. Drs. Fisk and Denison 252
The Effects of Dry Atmosphere on Chronic Inflammation of the Larynx and Nares. E. Fletcher Ingals, A.M., M.D. 254
Discussion. Drs. Atkins, Knight, Ingals 258
The Modification of Tuberculosis by Climate.—Report of Cases. H. A. Johnson, M.D. 262
The Climate of Ajaccio. A. Tucker Wise, M.D. 271
Ocean Climate. M. Charteries, M.D. 278
Remarks on Ocean Climate. W. E. Fisher, M.D. 282
The Climate of New Mexico as Viewed by the Medical Fraternity There. James H. Worth, M.D. 285
The Detrimental Effects of Over-Exertion in Pulmonary Phthisis. Karl von Ruck, M.D. 305
Tuberculosis in the Criminal Class. William Duffield Robinson, M.D. 317
Memorial of Dr. A. Y. P. Garnett 323

WELCOMING ADDRESS.

By Charles Denison, A.M., M.D., of Denver, President.

Gentlemen: It is appropriate that I should preface this seventh annual Convention of our Association with (1) a welcome to you who have come a long distance to be with us, and (2) some explanation of our efforts and their results to make this meeting a memorable one.

Of the first duty we do not believe you think it necessary for us to assure you of the heartiness of our welcome. We have wanted you to come for a great while, and now that you have come, we embrace you, and say, tell us how we can make your tarrying among us the success and pleasure it deserves to be, and we, one and all, will gladly be your humble servants to that end.

We have thought it eminently fit that an Association which is devoted to the subject of climate should once in a while meet in that part of the country which, while wonderfully rich in Nature's gifts, is especially blest in a climate which may be favorably contrasted with that of all other sections represented by the abodes of the Association's members. We have desired that you would come up here to investigate these claims yourselves, to see the brightness with which the sun shines and feel the expansive influence of breathing the rarefied air. We hope that the times and the skies may be propitious for a successful and happy sojourn for all of you.

At the same time, an apprehension creeps into our minds that we have too large a "leaven" of Boston brains, in the present grist from the Atlantic shore, for you all to enjoy uninterrupted Colorado weather. For it is said (and the state-

ment is borne out by many illustrations of its truth) that in Colorado, when a very dry season occurs, they do not have to pray for rain, but simply to introduce a new Raymond excursion party, and the thirsty land will be refreshed.

There will be so many opportunities for you, both by personal inspection and through social intercourse with Colorado physicians and others, to gain a knowledge of the growth and thrift of this city of Denver, of our mountain resorts, and advantages of scenery and out-door life, that I need not take your time by a rehearsal of them.

As to our sanitariums and health stations, I regret exceedingly that we have not more system and concentration of effort and purpose in their fostering and building up. The explanation of this crudeness lies in the circumstances under which invalids, pulmonary cases especially, come to Colorado. The field is very large and the country is very new. The great success which has been achieved by invalids since our earliest days, before the "palace sleepers" displaced the "prairie schooners," has been largely due to a vague system of "roughing it"—invalids living at suburban farms, country or mountain ranches, or at hotels or boarding-houses in the mountain glens—many of them camping out in tents from a sixth to half the time.

No doubt there are advantages peculiar to this haphazard sort of a method, or rather necessity, of segregation. The out-door living, the interest the invalid gains in the affairs of life, together with the browned skin and glow of returning health, make it sometimes impossible for the layman to tell who are sick and who are well. This circumstance, you will agree with me, is good at least for the invalid class. Then, too, it is often a necessity (perhaps happily so) that the patient, who has a life work before him, to keep well, must earn his own "bread and butter," and consequently forgets his invalidism in a healthful out-door occupation.

Please do not conclude that this reference to the hitherto natural, or necessitated, segregation of invalids in Colorado is offered as an argument against an enlightened congregation of them in possible sanitariums to be established hereabouts. For to those already started, as well as to those yet to come, every encouragement should and will be given. We need

more system, more attention to diet, care and amusement of invalids. And as to opportunities, "the woods are full of them," as they say, and many desirable localities along the base of the mountains, and in valleys and mountain parks, are only waiting for the right parties to take hold of them to become prosperous and popular health stations.

We will try not to be jealous of your success should any of you individually, or in combination with friends, become interested in such needed institutions in Colorado.

If any explanation is needed for the make-up, so to speak, of our present gathering—*i.e.*, the absence of many of the old members, and the presence, by invitation, of a good number of new men—the peculiar exigencies of the case are sufficient. In the first place, it was understood that one of the chief objects in having our Association meet in Colorado was to enable its Eastern members to meet the profession of the far West and hear their views, and join in the discussion of their Western experiences. We have, therefore, lengthened the sessions of this meeting a day, and invited representative men from New Mexico, Arizona, Utah, Colorado, etc., to present for your consideration the subjects you wish most to know about.

Then, there are some physicians who, though not heretofore members of this Association, are quite as much interested in its object in coming to Colorado. Such of these as I have heard of I have given to understand that they would be cordially welcome to join us on this occasion. We could not tell in advance how much the unfortunate occurrence of our meeting near the time of the Berlin Congress gathering would decimate our own ranks. In fact, when the postponement of our annual session to the present time was proposed and considered, I was myself deceived as to any serious conflict in time being possible. It was too late for any further postponement when this difficulty was discovered, and we can only voice a sincere regret that half a dozen or so of our best men are prevented from being with us because of the Berlin Congress. Doctors Pepper, Kretchmar, and others have written wishing us success, and bemoaning their fate that their arrangements did not allow of their returning from Europe in time to be with us. Dr. Gihon, especially, wished me to express for him his appreciation of the honor conferred in his election to the

Vice-Presidency, and his great regret that business matters detain him on the Continent after the Berlin meeting.

It has seemed to me that the Association would feel inclined to consider some of the invited gentlemen mentioned, who are not yet members, as, in a measure, substitutes for this uncertain contingent, and that you would willingly join your President in welcoming them to a participation in our proceedings. Among these gentlemen, whom we are pleased to see present, are Drs. Wainwright, Wolcott, Fischer, Kellogg, D. M. Yardell, Standart, W. R. Tipton, Hamilton, Anderson, G. W. Foster, F. A. Atkins, Dodge, Robinson, Donaldson, Pitner, Adams, Jones, Wadsworth, French, Risley, and others, including the members of our social committee.

Personally I should be gratified if the council would choose from our invited or transient members a goodly number for permanent membership, with, if you please, the avowed purpose to make the Association more extended in its workings. If it is necessary so to do, in order to carry out this purpose, I would recommend that the Association's limit as to membership be extended. I do not wish to be understood as arguing in favor of a strict geographical distribution of our membership. That would be even more incongruous than our present make-up, with about half the membership from four cities and two thirds residing east of the Alleghany Mountains. The idea that I wish to impress is, that the wide scope of its chief study—climate—and the national character of the organization necessitate a consideration of both brains and geography. Somewhere between these two essentials there is a mean to adopt, which will bring our Association to its greatest success. We congratulate ourselves in having an organization whose noble aim is not only not excelled by that of any other scientific body, but which deeply interests some of the brightest minds in the medical profession, and nearly or relatively affects the whole human race. It needs no extended argument to convince you, gentlemen, that the study of climate, with reference to pulmonary diseases, is more important than that of any known therapeutic measure, especially with reference to that dreaded disease *consumption*. Therefore, I am personally not only sincerely thankful that I was numbered among the founders of our Association, but I am deeply grateful for

and appreciative of the high honor you have conferred upon me in placing me in my present position as President of this body. Besides, and this not the least of all, I am happy that, in the name of our *confrères* of the Rocky Mountain region, I can and do bid a hearty welcome to the American Climatological Association.

On the conclusion of his salutation, the President stated that he had messages from Drs. Cammann, of New York; Thomas Darling, of Bisbee, Ar.; James H. Wroth, of Albuquerque; Jacob Reed, of Colorado Springs; J. H. Tindale, of New York; B. F. Westbrook, of Brooklyn, N. Y., saying that on account of sickness or other causes they could not be present.

It was moved to delay the discussions of the different excursions until all the members who were to be present should arrive.

Dr. R. G. Curtin, of Philadelphia, moved that the visitors present participate in the discussions. Motion adopted.

The President then proceeded to deliver his Annual Address.

ABNORMAL INTRA-THORACIC AIR PRESSURES, AND THEIR TREATMENT.

ADDRESS OF THE PRESIDENT, CHARLES DENISON, A.M., M.D., OF DENVER, COL.

In considering the subject of Intra-Thoracic Pressure in relation to disease, it will be necessary to forego elaboration, limited as a treatise like the present is by the time alloted, and the fear of taxing your patience.

In fact, the largeness of the subject and the intricacy of its many details convict me of an almost unwarrantable boldness on my own part in essaying to elucidate it. One should be thoroughly versed in chemistry, physics, anatomy, and physiology, have an extended experience with the many diseases involved, and be possessed with a certain faculty for invention, to treat the subject as I believe it should be done. The last two prerequisites—perhaps I should say the last alone—are the only reasons why I make this attempt.

We are all students, and as such I assure myself of your sympathy, with the hope that some new presentation of old truths may lead up to useful modifications of old methods, or the inauguration of new ones, with reference to the management of throat and thoracic diseases, involving abnormal conditions of air pressure within the lungs.

It may appear to you that the subject is an innovation, in the light of the popular tendency to bacteriological investigation at the present time. Yet the conditions, as to the circulation of both air and blood within the chest, are so positive and the results so conclusive, could we fully know them, that only help and encouragement for every other method of studying disease can accrue from their investigation.

Presupposing a familiarity with the anatomy and physiology of the circulation of the blood, first through the *lesser circuit*, the pulmonary circulation, and, second, the *greater circuit*, the systemic circulation, let us refresh our memories with regard to the amount of air used in

RESPIRATION.

For a person who has a total lung capacity of 323 cubic inches, the average for an ordinary sized man, the relative proportions of this volume of air are distributed about as follows :

The breathing or vital capacity—a forced expiration after the deepest possible inspiration—225 cubic inches.

This amount includes the *complemental air*, 98 cubic inches—*i.e.*, the air that may be inspired after an ordinary inspiration ; the *breathing* or *tidal* air, 30 cubic inches, which is the air inspired and expired at an ordinary breath ; and the *reserve* air, 97 cubic inches, which is that which may be expired after an ordinary expiration.

This leaves within the lungs the *residual* air, 98 cubic inches, which is about equally divided between what is called the *collapse* air, that which will escape from the lungs when the chest is freely opened, and the *minimal* air, that which will not so escape.

Thus it is estimated that one tenth of the total lung capacity is breathed at an ordinary breath, about three tenths can be inspired after such an inspiration, and three tenths can be expired after such an expiration, leaving three tenths within the lungs, the residual air which cannot be used.

Then, the vital capacity of an individual, which is seven tenths of the total capacity, contains the complemental, the tidal, and the reserve air. This vital capacity, or spirometrical record, varies greatly with different individuals, being modified by age and such conditions of life as affect the physical well being. Chief among these modifying conditions is the length of the spinal column, the variation being for heights of individuals from five to six feet 166 to 262 cubic inches for males, and 128 to 224 cubic inches for females.

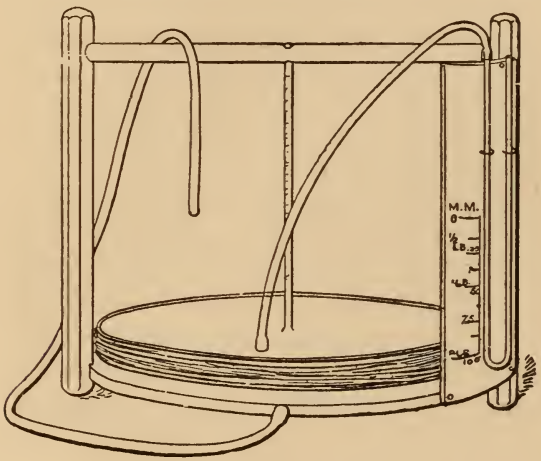
I find the use of the spirometer, for determining the extent of lung disease, is much distrusted by authors. To be sure Hutchinson made elaborate experiments and gained great confidence in this method of investigation ; but he devised a nearly perfect instrument, though too troublesome and difficult to accurately manage for general use.

Having taken the spirometrical record in over four thousand examinations, and always found a certain harmony to exist between that record and the impaired lung space, I never

could understand the ill opinion authors had of the spirometer until lately, when, comparing three different instruments, I found they varied over eighty cubic inches in the measurements each recorded. Of course, we must have some sort of accuracy and uniformity in our records. Then, too, there is so much resistance to expiration in the rubber bag of Marsh's spirometer, that I have repeatedly failed to get a fair record with delicate patients, particularly women. You will see by the experiment I will try that it takes considerable pressure to distend this rubber bag.*

Another spirometer, somewhat after Hutchinson's plan, was sent me, which might have been a good one had the inventor's intentions been carried out, but it was less reliable even than Marsh's, and only served to show the bad policy of medical men giving their inventions to irresponsible instrument makers.

The spirometer I here show you is the result of my own experimenting, and I trust it will commend itself to you as a faithful measurer of vital capacity. When full, it is a hollow cylinder, 11.28 inches in diameter, standing on end, the two ends being closed, and the sides made of one piece of light, impervious cloth.



The structure is so light as to give little or no resistance to the expired breath. That resistance when desired, however, is intended to be used and measured by weights placed on top of the cylinder, or by a manometer attached, so as to determine the expelling force, in pounds pressure, each individual may have.

* This consisted in a test of the two spirometers with a manometer, showing that the force required to distend the Marsh rubber bag was over 20 mm. of mercury, while that required by the new spirometer was hardly perceptible.

The contents of each inch rise of the top of the cylinder is intended to be 100 cubic inches ; so each successive expiration (and the spirometer will hold three or four full breaths) helps to make a correct average. The top of the cylinder is compelled to rise parallel to the base by the recording piston moving up and down inside a tube or guide placed above.*

It would seem to be in harmony with Nature's usual bountiful provision for every need, that the entrance and exit of air would be provided for, so that there would be no rarefaction within the thorax with inspiration, nor condensation of air with expiration. We shall see, in noting the influence of respiration upon the blood circulation, that this provision is not only *not* so complete, but we may go farther and learn that the opposite effects are of positive utility—*i.e.*, that rarefaction and condensation are essential features of healthful respiration and circulation. We have seen how small a portion of the contained air is breathed in ordinary respiration. This was made by Davy a basis for determining the change in the air which each ordinary breath produced. He analyzed the expired air after an inhalation of pure hydrogen, and found that about one third of the hydrogen had been exhaled in the first expiration following, and two thirds had remained in the lungs. Thus it was shown that twenty cubic inches, or one fifteenth of the total capacity, was displaced by fresh air at each ordinary respiration. It must be constantly borne in mind that this is, though normal, but the minimum change which takes place in the contained thoracic air, and that the great elasticity of the thoracic organs gives proportionately exaggerated effects. By means of the manometer, the negative pressure, or aspiration force of the air in a man's lungs, has been determined to be equal to 3 mm. of mercury, when there is no obstruction to the air entering and during an ordinary quiet inspiration, and the positive pressure is two to three mm. during expiration. In forced inspiration the suction power may reach 57 mm. of mercury, and the positive pressure of forced expiration may be represented by 87 mm. When the entrance or exit of air is prevented by closure of

* Arrangements will be made with George Tiemann & Co., of New York, and with Charles Truax & Co., of Chicago, to supply physicians and others with this instrument, and the Portable Lung Compressor, hereinafter described.

the great air tubes, the limits of pressure may reach 74 mm. for the negative condition of inspiration, and 100 mm. for the positive pressure of an extreme expiratory effort. Here is a possible variability which represents from 15 to 30 times the effect of ordinary quiet breathing, limits which, though not often reached in the majority of individuals, yet in some are frequently approached during exercise, lifting, riding, or singing, and in others, either partially or generally throughout the chest, under various conditions of disease.

In this connection, if time permitted, it would be interesting to study the results of augmented pressure upon the human body, as shown in the "caisson disease." However, the effect of breathing and being in the condensed air of the caissons is not as much shown on the lungs, whose elastic walls allow nearly corresponding adjustment, as upon the dense internal organs, and especially upon the delicate contents of the cranium, vertebral column, and long bones, where adjustment is impossible and the over-distension of blood vessels leads to forms of paralysis.

These effects do not immediately accrue on the subjection of workmen to the two or three atmospheres found in the caissons, but afterward, when this extra atmospheric pressure is removed. The circulation or density of the blood seems to bear the brunt of this augmented pressure, whereas, were it an increase in volume of air breathed, as in balloon ascensions, additional results in the lungs might naturally be looked for, due to the over-distention of the air cells.*

The ventilation of the pulmonary passages and air cells, a probable effect of ever changing intra-thoracic air-pressure, is a very interesting process, favoring the conclusion that even in health this pressure may not be exactly equal, nor the supply of fresh tidal air the same, in all portions of the lung. The residual air which is in the alveoli must depend on diffusion for its purification, while the reserve is mixed with the fresh tidal air in the passages, largely through the force of inspiration. This diffusion is both rapid and complete, according to

* Dr. A. H. Smith, New York, 1873, "The Effects of High Atmospheric Pressure, including the Caisson Disease."

Dr. J. L. Corning, "Observations on the Caisson or Tunnel Disease," New York *Medical Record*, May 10th, 1890.

the extent of the respiratory process, Wolfberg having determined by experiment that the composition of the alveolar air did not differ greatly from that expelled in a *full* expiration. Short of a complete use of the lungs, however, the supply of oxygen is not always alike in all portions of the lung periphery, showing the great agency of muscular exertion in supplying this vivifying element to thirsty regions.

In support of this note the fact that one can hold the breath longer through muscular motion (the alternate movements of the chest and diaphragm) than by perfect rest. There is undoubtedly an adjustment of intra-thoracic pressure, not only to the requirements of blood changes, but also to those of all kinds of muscular exertions, including coughing, sneezing, and the intricate processes of vocalization.*

Physiologists have come to the conclusion that the source or governing power of all this respiratory activity, the so-called respiratory centre, lies in the medulla.

This was proved, in 1879, by Professor Austin Flint, Jr.,† who showed that no respiratory efforts would be made by an animal when the thorax was opened and artificial respiration was kept up sufficiently to thoroughly aerate the blood. However, if the vessels going to the medulla were clamped, thus shutting off the entrance of arterial blood to the respiratory centre, violent respiratory movements were made, though the rest of the body was well supplied with arterial blood. But if these clamps are so applied that oxygenated blood can go only to this respiratory centre, no efforts at respiration will be made, no matter how great the demand for oxygen may be in other parts of the body.

It is believed that the stimuli for the work which devolves upon this respiratory centre exist in conditions of the blood supplied to it—*i.e.*, if there is a deficiency of oxygen, the de-

* "The general conclusion to be drawn from these considerations seems to be that while the main volume of the vocal blast is properly supplied by the steady sweep of the diaphragm and abdominal muscles, the accent which gives life to song and speech is accompanied and supported by a characteristic play of chest and diaphragm, in which the rapid changes of the fundamental note of the great thoracic resonator adjust it anew for every note sent out from the vocal cords" ("Diaphragmatic and Costal Respiration," by H. Sewall and M. E. Pollard, in *Journal of Physiology*, vol. xi., No. 3, 1890).

† See article on "Respiration," vol. vi., *Reference Handbook of the Medical Sciences*, page 208.

mand for a renewed supply is sent out by this centre to the inspiratory nerves, and the resulting effort at inspiration seems to be without reference to carbon-dioxide, which has to be thrown off; while, on the other hand, if there is an excess of carbon-dioxide in the blood, the stimulus is sent out from the respiratory centre, especially to the expiratory nerves.*

How the application of pressure may serve to liberate the carbonic acid which the blood contains has received a curious explanation by V. Fleischl. He conceived that the union of this gas with the blood was in such close combination that the gaseous molecules had lost their physical properties as gas, and behaved like liquid. In this state the shock of the right heart, in forcing the venous blood into the lungs, served to separate these molecules and to leave them in a gaseous form, in which state they are more readily thrown off in the alveoli of the lungs.

In support of this theory he referred to a simple experiment, which any one can try. Take a glass syringe, with a close-fitting piston, and draw it slowly half full with water; close the end while still under water, and then gently raise the piston to its full height. The negative pressure used on the liquid causes a few bubbles of gas to form on the sides of the glass. After returning the piston again to the fluid's level, draw it half way up and let it go, when it will strike the liquid with a certain shock. Now, immediately pull it up again, and the liquid is seen comparatively to boil with the ebullition of gas produced. According to Fleischl's idea, this greater liberation of gas is due to the preceding shock produced, which process he claims is analogous to the heart's influence on the venous blood as it enters the lungs.†

I.—THE INFLUENCE OF RESPIRATION UPON CIRCULATION.

Among the forces which have an influence upon intra-pulmonary pressure, one of the most important is the circulation of the blood, or varying tension of the blood current all along the line through the arteries, capillaries and veins. The power of the heart is not only sufficient to force the blood

* If this excess of carbon-dioxide is clouded by an excess of oxygen, the former gas poisons the animal, and he dies without spasm.

† H. Newell Martin and W. H. Howell in Sajous' *Annual* for 1888, pp. 340–41.

throughout the extended arterial system, but a push is given which helps this flow onward through the capillary system. This means more for the pulmonary capillaries than for those in the skin, because the movement in the former is five times as rapid as in the latter, the passage of blood from artery to vein in the human lung, according to Draper, taking only one second of time.

On the other, the vinous side of this circulation action, it is said the jugular vein is so strong it will support a column of water 148 feet high, and the portal vein a pressure of six atmospheres.

All of which tends to give an idea of the resistance of the circulation vessels to any influence outside of them.

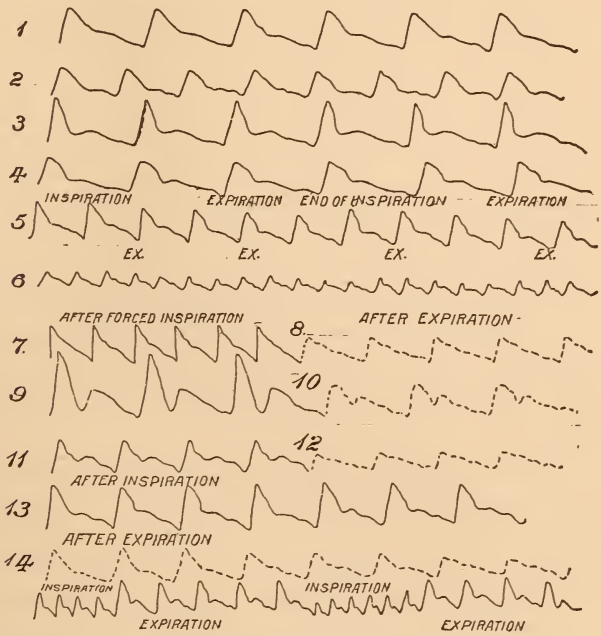
However, the vis-a-tergo of the circulation, contributed by the heart, is not only not a constant, but it is an intermittent force, notwithstanding that intermittence is considerably modified by the contraction or recoil of the arterial walls. Besides, we must not forget that there is a great difference between the lesser, or pulmonic, and the greater, or systemic circulation of the blood, both as to the delicacy and distensibility of arteries, capillaries, and veins. It would seem that this greater susceptibility of the pulmonic vessels is a natural provision for the influence we are coming to consider—namely, the suction and propelling force of respiration on the circulation.* Keep in mind the constant operation of atmospheric pressure under which the heart is receiving and pumping the blood from within the thorax back to the same regions again. The expansion of the chest in inspiration, with the great sweep downward of the diaphragm, creates a counter force to this atmospheric pressure, which may be little or much, but is always something. This depends greatly upon the freedom with which the inhaled air enters, and the quantity required,

* In this connection I wish to note that Dr. J. West Roosevelt (see *Medical Record* for February 22d, 1890) presents an important characteristic of the pulmonary venous circulation. After showing that the veins are farther from the bronchia than the arteries, and are more tortuous and more loosely held by pulmonary elastic tissue, he says: "It is evident that the veins are so placed as to tend to be held open during inspiration and expiration, by the tendency of the elastic tissue to contract toward the bronchiæ. They are so placed as to be practically uncompressed by the atmosphere. In fact, they may be said to run always through those parts of the chest in which there is nearly perfect balance between the contractile power of the lung and the atmospheric pressure.'

whether it is the minimum fifteenth or the maximum two thirds of what the lungs can contain. The greater the tendency to a vacuum in the thorax, the more is the blood, though a less flexible fluid than the inhaled air, called upon to fill the vacant spaces. On inspiration the right side of the heart is relieved by suction of its contents to a certain extent, while the blood which should flow on to the left auricle is restrained somewhat within the expanding lung. In other words, the outflow from the heart to the lungs is hastened and the inflow retarded. This is only a temporary tendency to stasis. The opposite condition supervenes on the advent of expiration, with the coincident contraction of the chest walls. Not only is the outflow from the right side of the heart retarded by this pressure exerted on the now distended pulmonary vessels, but the inflow of venous blood to that side is stayed, while the arterial or newly oxidized blood is hastened on into and through the left side of the heart. The heart then works as an aspirator, as well as does the thorax, these two reciprocally aiding each other in the onward propulsion of the blood. It is then a question of distribution of pressure, in which respiration takes a vital part. The tension of the blood, or mean blood pressure, will be changed with every disturbance of this wonderful arrangement, such as Zuntz describes, the opening of the chest wall thereby stopping its aspiration, the breathing out into rarefied air increasing, and inspiring compressed air decreasing this blood pressure.

While in Dr. H. A. Johnson's office, in Chicago, a few days ago, we were discussing this question of the "influence of respiratory activity upon the heart's action." The idea occurred to me of having sphygmographic tracings made of the pulse wave under varying conditions of breathing. Dr. Johnson and his son kindly made the accompanying tracings of my own pulse under the following conditions: First, ordinary breathing, twenty breaths a minute sitting; 2d, same, forty breaths a minute; 3d, lying down, holding breath after several breaths and a full inspiration; 4th, holding breath after one complete expiration; 5th, slow full inspirations and expirations regularly alternating. In this last an effort was purposely given to the close of inspiration, thus bringing into use the whole of the complemental air.

I have also added nine other tracings of five persons, including two children (Nos. 6, 7, and 8), which, like many others taken since, are confirmatory of this general proposition, that *the heart always works in harmony with intra-thoracic air pressure*—in fact, that its working depends largely upon that ever-changing condition.



In seeking an interpretation of these pulse waves, it is instructive, in the first place, to note the differences in tension and rapidity of action between tracings 1 and 2, which were made under similar conditions, except that forty succeeded twenty respirations per minute. The rise in systole for forty breaths is seen to be much less than for twenty breaths per minute ; but this deficiency is more than compensated for in the increase of about thirty per cent in the rapidity of the heart's action.

So far as I know, physiologists have not formulated any law of relative increase of heart's action in consonance with rapidity of breathing. These two tracings, however, would seem to show that a given percentage of increase in respiratory activity is represented by a compensatory increase of the

heart's action of about one third as much. Of course the uncertain depth of breathing must be reckoned among other modifiers of any proposed rule.

Tracings 3 and 4, as is the case with the confirmatory ones, 7 to 14 inclusive, show in a positive way the influence intra-thoracic pressure has upon the tension of the heart. In 3, 7, 9, 11, and 13, tracings were taken while holding the breath after four full breaths were taken, and then the fifth was held in. This gave a large supply of oxygen and complete distension of the thorax; while in experiments 4, 8, 10, 12, and 14, inspiration was withheld after simply expelling the reserve air which happened to be contained in the lungs. This left only residual stagnant air in the thorax, making it decidedly negative as to the interior pressure. The uniformity with which the rise in systole in the first exceeds that of the second series by thirty to sixty per cent, makes it unnecessary for us to delay upon this point. The heart, as well as the lungs, must have air, because the heart's use of the blood depends upon the oxygen in the inhaled air, as well as upon the intra-thoracic pressure.

Notice, in illustration of this necessity, the failing of tension toward the end of the experiment, in pulse wave No. 14, in a girl fourteen years old, when the supply of oxygen as well as the remaining tension in the heart had been nearly exhausted. Tracings 5 and 6, the one of my own pulse with inspiration slow and full, and expiration passive; and the other of my son Henry, seven years old, with expiration evidently forced, serve to show that the pressure is in that part of the act of breathing where we put it, and that any unusual change in that pressure may be registered on the pulse wave.*

* Tracing No. 15 illustrates what I meant to have shown with reference to membranous croup, could I have reached that part of our subject. It is an early indication for intubation in some cases, which I have noted in two of my recoveries—namely, the evidence of commencing aspiration in the chest, indicated by a feeble pulse during inspiration and stronger during expiration. It is difficult to get this effect in the healthy subject, because such an exaggerated effort at inspiration, with the nose and mouth closed, may be made as to increase instead of lessen intra-thoracic pressure. This tracing (15), one of the best obtained, was taken while a young man made an effort at inspiration and expiration with the great air passages closed. It shows the weak tension during inspiration and high tension during expiration. See "*A New Mouth-gag*, together with the Consideration of Other Possible Aids to Better Results from

How far one may control the action of the heart by means of self-increased intra-thoracic pressure is an interesting investigation introduced by Ewald and Kobert,* "who would scarcely be able to doubt that a man could even in this way commit suicide." They ask, "What is the explanation of those remarkable suicides occurring suddenly, without external injury or poison?" Weber offers an explanation. He observed that by a marked increase of intra-thoracic pressure he could stop the action of the heart—that is, he could no longer perceive any action. But in reality the heart had not stopped beating, only it beat so noiselessly that the beats were not observed.

These writers had opened the abdomen of dogs and observed through the diaphragm by feeling the condition of the heart. Through a tracheal canula they distended the lungs with air to 250 mm. Hg., without the heart ceasing to beat. When at the same time pressure was made externally on the thorax and upward against the diaphragm with great force, the heart still beat. Indeed, the increase of intra-thoracic pressure acted advantageously in "releasing the heart contractions," and the beast survived a long time, just as in cold-blooded animals. But if a bloodless heart was made motionless, the intra-thoracic pressure could not be increased to a point to cause death. The medulla oblongata retains its functions longer than the great brain syncope would occur, and by intermitting the pressure the heart would again begin to work.

The above may serve as an illustration of how easy it is to be led aside by the many extremely interesting phases which our subject develops in its unfolding. We will hereafter endeavor to confine our study to the limits prescribed by disease.

The abnormal states of intra-thoracic pressure which need to be considered are especially those which are characteristic of the (1) fibroid process, (2) atelectasis, (3) asthma, (4) emphysema, (5) bronchiectasis, (6) pulmonary hemorrhage, (7)

Intubation of the Larynx," *Journal of the American Medical Association* for June, 1890.

* "Ist. die lunge loftdicht," Archiv. f. d. ges. Phys. XXXI., 1883, pp.16–186.

empyema and thoracentesis, or (8) the drainage of pulmonary cavities, and last but not least (9) membranous croup, or any stenosis of the larynx. I will treat only of the first four in this paper.

I.—THE FIBROID PROCESS.

The deposit of fibrous material, which is the accompaniment of every infarction of the bronchial or pulmonary tissue, is a most potent factor, for good or for evil, in almost every lung disease. It is meant to be a saving grace, but is sometimes turned into a most relentless enemy of human life. It seems that Nature, just as she is more than bountiful in the opportunities offered for the propagation of the species in the lower forms of life (notice the myriads of pollen from trees or spawn from fish which never come to any fruition), is equally bountiful in the supply of remedial tissue when once the lung has become injured. But she has no discrimination in the bestowal of her balm, and as a result how often do we see a whole lung bound down as to its periphery just because of an injury of or irritative deposit in one portion! One cannot have taken the spirometrical records of a large number of pulmonary invalids, and not have been impressed with this factor of fibroid contraction. One may be able successfully to conceal his fears for his patient's future beneath a serene and hopeful countenance; nevertheless, in his secret heart he knows he has a difficult problem before him when he is required to advise a man who can breathe but 90 cubic inches, who in health ought to expel 250. Yet this man has no fever, and his pulse and respiration when sitting, and not talking, are very little if any exaggerated, and his lung or lungs, upon a physical examination, show the full amount of contraction, through fibroid deposit, which the spirometer indicates. Such illustrations have so much impressed me, and the fibroid process is so important a factor in high altitudes, that in the discussion of "the use of inhalants in lung diseases," in which I participated during the meeting of the British Medical Association in Glasgow, summer 1888, I chose the negative side of the question. I claimed that the inhalants do not, as assumed, reach the air cells, and even if they could they do not enter on the diseased side, because they cannot on account of

the fibroid accompaniment usual in these chronic lung cases. The inhalant intended for the diseased though contracted lung is naturally diverted to the sound and useful side.

The trouble is that the bronchial tract, as well as the vesicular portion of lung, is encroached upon by this fibroid process, and in consequence the flexibility and use of the whole organ is impaired. There may be, and there usually is, over-distension of healthy portions of the unaffected lung, due to the supplementary tension there induced, but, on the other hand, there is the inherent fibroid contraction of the affected portion, which, though a healing process, will result in strangulation of the function of that part if its progress is not opposed. Through a recognition of this hopeless tendency comes the suggestion of the only means of cure. We must oppose this ever-increasing positive pressure within the lung, yet outside the contained air, with an equal tension within the air spaces. If possible the function of the lung must be stimulated into activity, so that a certain normal resiliency of the aerating portion may be maintained, which I shall hope to show (under the discussion of atalectasis) is an essential factor in inspiration.

I know of no medicines locally applied which can have the least influence in opposition to this contracting process. The desired counter-pressure comes in the appropriate application of rarefied air. Nothing can be better than the lessened atmospheric pressure of a properly chosen climate—*i.e.* (1) that the attenuated air should be dry, because thus its absorbent qualities are increased and the possibilities of irritation lessened ; (2) that it should be cool or cold, because then its expanding power, its absorbing capacity,* and its stimulation are increased ; (3) that it should if possible have besides advantages which are claimed for other or high-pressure though low-lying climates, such as the *purity* due to sunshine, ozone, atmospheric electricity, mountainous configuration, dry soil, and absence of irritating dust or gases.

It is right here, with reference to this fibroid process, that the great utility of the high-altitude treatment is manifested. Its broad scope is outlined by the statement (which I think

* See author's " Preferable Climate for Phthisis," Report to Ninth International Medical Congress, pp. 4–5, Tables I.–III.

you all will agree with me in making) that *the fibroid process is an essential part of nearly all pulmonary hæmorrhagic infarctions, of all chronic pneumonic infiltrations and old tubercular ulcerations or lesions.*

Though it may seem incomprehensible at first that a lessened pressure of the breathed air may produce a relatively increased intra-thoracic pressure, yet such is, I think, susceptible of positive proof, which is abundantly verified by experience. Study the pulse waves already introduced as we will, they conclusively show, what we might expect them to show, that the heart indicates power in its action according to the intra-thoracic pressure, and to the volume of air supplying oxygen to the blood.

Now the volume of air breathed is greater, as shown by the increased depth and rapidity of respirations, when one first arrives at a high altitude. This is in consonance of course with the height reached, or the deficiency of oxygen due to the rarefaction of the air. Add to this the absorbing and expanding influence of the dry cold air when breathed at the greater height, and a greater amplitude of breathing is developed, which shows a positive increase of intra-thoracic pressure as compared with the circumambient air, and as compared with the like estimate at a low level. The effect on the circulation has already been referred to, and as a salutary factor in the cure should be duly credited.

The successful altitude need not be so high but that healthful exercise may be daily taken by preference in the open air, of course graduated and regulated to suit each individual case. I am aware that I am running counter to the opinions of several of my colleagues in insisting upon a certain amount of regular bodily exercise, even to the extent of forced pulmonary activity after the patient has become acclimated to the chosen elevation. I cannot conceive it as best that such a patient should remain in bed or perfectly quiet continually at any considerable elevation. The probabilities are that such a one is too high up, if such quietude is imperative. I will admit that the greater the elevation the less is exercise a necessity, and that many might perhaps better be higher up and exercise a minimum amount than at an insufficient elevation and exercise a great deal; but that they can exercise

none at all is most unfortunate. The clearing-out process, due to the increased intra-thoracic pressure, and the prevention of the ever-impending collapse of the air vessels in the affected lung, should be regularly attempted by bringing into use, if possible, both the *complemental* and the *reserve*, in addition to the *tidal* air. This is, as before intimated, a battle for supremacy between the individual and the fibroid process, in which fight Nature, if not pitted against the individual, is at least greatly mixed as to which side she will give her allegiance.

The following two cases chosen from my list are given as illustrating respectively, first, the need of exercise, and, second, the great good of a high altitude climate in such a case.

1. G. W., 35, married 10 years. Gloucester, England. Agriculturist. Mother had eight children (two pair twins), and had consumption. Died two years after this patient was born—only three of children living. The others died in infancy. Three years ago took cold, and has had a cough since, except in upper Engadine a year ago last November, where he remained until April. After returning in spring, suffered a relapse, and did poorly in Bournemouth in May. Afterward had a hæmorrhage. Dr. C. T. Williams advised him. Improved at home during the summer. Came to Colorado November, 1889. Dyspnœa on arrival. Of late had eczema. Weight in health, 190; on arrival, 170; now 160. Has not done well. Has no appetite and is languid. Food may not have been good at Canon City, where he has been loafing all winter. Thought it best not to exercise. Expectoration little now; it was profuse before going to Switzerland, 1879; bowels not regular now; sleeps little, because of night sweats. Temperature, 97; respiration, 36; pulse, 90; spirometer, 86; height, 5.10½. Measurement, left, 17½ in.; right, 18½. Movement *nil* on left, and one inch right. Slight dulness, right infra-clavicular, and broncho-vesicular respiration infra-scapular. Dulness more or less over the left, and no vesicular murmur. Moist rales infra-clavicular and mammary, and exaggerated voice and whisper there, also rear; base closed up. "Cracked metal" (?) through the upper part of the left. Diagnosis, fibrosis 2d (3d ?), left, and right first stage. Gave alterative treatment, and iodine externally, and gymnastics. Decided also to try the pneumatic cabinet.

April 24th. Expansion, 32½ to 35 inches. Has had 12 séances in pneumatic cabinet. Spirometer, 96. Seems to have improved; will now ride horseback. Continued to improve slowly, and went to England about June 1, and not been heard from since.

DENVER, COL., March 15, 1889.

2. R. B., aged 16, Bangor, Me. At school till last November. Mother and children, who take after her, delicate: her father and uncle had consumption. A year ago the patient began to cough, and by November Dr. Simmons pronounced the right lung affected. Dr. Knight, of Boston, thought he had improved when three weeks ago he made an examination. No hæmorrhages or night sweats, but has had some chills and fever. Diarrhœa on November, December, and January, at which time he left school. Expectoration muco-purulent mornings. Weight in health, 100; on arrival in Colorado, 105. Arrived four days ago and feels elevation by dyspnœa on exertion. Is quite hoarse, and throat is sore, especially when he coughs. Sleeps well, appetite good, and bowels now regular. Pulse, 98, respiration 20, temperature 99, 3 P.M. Height, 5-6½; spirometrical record, 135 cubic inches. Expansion, 27–29; measurement, right side, 12½; left, 14½ inches. Movement, ½ on right, and over one on left. Right infra-clavicular, infra-mammary, and lower-axillary regions much shrunken. Creaking at end of forced inspiration in right mammary region, and otherwise feeble respiration, with a few scattered rales on right side. Think the shrinkage may have prevented excavation. However, there are suspicions of bronchiectasis, or excavation in right interspinatus. There are subcrepitant or friction rales at base of left infra-mammary and lower axillary regions, where six weeks ago he had some pleurisy. Diagnosis, fibroid phthisis, 1st (3d ?), right, fibro-pleurisy 1st left.

Re-examination May 31st, 1889.

Been in Denver; averaged 6 hours out-of-doors daily. Weight, 110. Bowels regular and appetite good. Cough improved. Pulse, 98; respiration, 18; temperature, 98.5, 3 P.M. Expansion, 28 and 30½. Right measurement, 13¼; left, 15¼. Some moist rales in right infra-clavicular space and almost "cracked metal" in third inter space, but no marked cavernous voice. Left lung expanding and heart moved toward the shrunken right side. Arrest.

Re-examination September 21st, 1889.

Been in mountains above Morrison and up to Georgetown. Did well, except when he had a cold in August. Returned to Denver two weeks ago. Weight, 112. Enjoys riding horseback and feels well. No P.M. hectic, hæmorrhages nor chills. Pulse, 96; respiration, 18; temperature, 98.3°, 3 P.M. Movement, right, 14 and 14½ inches; left, 16 and 16¾; expansion, 28¾ and 31½. A decided gain. Spirometrical record, 158 cubic inches. The depressed right infra-mammary region much improved. There are fewer rales in right apex, and no decided "cracked metal" sound can be found.

Re-examination April 21st, 1890.

Has improved since last examination in general condition. Had la grippe in January, but got over it nicely. No cough now; weight, 117. Is most of the time out-of-doors on horseback, either in or near Denver. Pulse, 74; respiration, 16; temperature, normal; spirometrical record, 170. Expansion, 29 and 32 inches; gain 3 inches, after inspiration. Right, 13½ and 14½, and left 15½ and 17½. Now first noticed slight dorsal curvature to left. Left lung is opening up; no rales, but there are the vesiculo-tympanitic percussion and breathing sounds of slight emphysema, accompanied by bronchophonic-voice in right inter-scapular and almost "cracked metal" on stethoscopic percussion in the right mammary region. Dulness below this, and heart more than half of it located to right of median line. The shrinkage outward (middle of right lung), apparent in this case, is characteristic of some recoveries in high altitudes. Wants to go East. Will allow him to go to the woods in Maine, keeping up horseback exercise, etc., during June, July, and August.

II.—ATELECTASIS.

This is another abnormal pressure state that is extremely difficult to deal with. In its immediate effects it is much like the permanent results of fibrosis, as useless as it is troublesome to manage, for it is simply the extreme of intra-pulmonary negative state as to air-pressure. The circumstances under which it occurs are numerous, but principally are hindrances to the entrance of air within the vesicular portions of lung, as in stenosis of the larynx from any cause, or from pressure on the lung from without, as in pleuritic effusion, pneumo-thorax, etc. As before stated, the air pressure is *nil*, and the lung simply collapses.

Some interesting experiments have been tried upon dogs, with reference to the production of this condition.* Dr. O'Dwyer, in an initiatory experiment, found that collapse of one lung, due to opening the chest wall, the sound lung being distended by a full inspiration, is followed by spasmodic contraction of the expiratory muscles, which condenses the air. The rapid escape of this being prevented by partial closure of the glottis, a portion of it is pumped into the contracted lung. If these forcible expiratory movements be repeated in quick succession, the collapsed lung is not only expanded until it fills

* Researches of Loomis Lab., pp. 53–57.

its cavity, but a portion may even be driven through the opening in the chest wall.

Dr. W. M. Northrop, in his first experiments, found that recession of lung occurred at once on making even a pin-hole opening in the pleura. In a second experiment, after opening the pleura, the dyspnœa which resulted was slowly relieved on insertion of a canula and cork. The other pleura was then opened, canula and cork inserted. The dog came out from the ether, got on his feet, and trotted back to his corner; seemed comfortable; breathed like another dog which had taken ether simply. When one cork was removed, some dyspnœa appeared, not much. Both corks were then removed at same time. "He stood for a moment dazed, panting moderately, answered a chirping call, wagged his tail, and trotted off to the next room, among the monkeys and guinea-pigs. From there he was brought back and tied to a table leg. This was about two minutes from the removal of both corks. Now began his severe dyspnœa, and it seemed to overwhelm him rather suddenly. He wavered to and fro. His eyes, tongue, and lips became dusky; and, with feet braced wide apart, he wavered and settled slowly to the floor. Here he lay flat on his belly panting. Both corks were now replaced as before, catching the moment of finished expiration, in order to leave as little air as possible in the pleural cavity. In a few moments he was again as well as ever. With one cork out, the dog had suffered no dyspnœa when quiet and out of ether and on his feet. With both out, he succumbed in two minutes to urgent dyspnœa with deep cyanosis. I may add that the result of this experiment is quite in accord with the experience of Dr. (W. Gilman) Thompson on former occasions."

3d series: Dog. Large opening made in thoracic wall, practically obliterating the wall. Dyspnœa and shock very severe. He seemed about to succumb. "Just at the instant of a severe spasmodic expiratory effort, a piece of plain glass was placed on the wet tissue of the wall, closing the opening. The dog resumed its respiration; the lung was seen to gradually expand, become rose colored, and nearly fill the cavity. In another somewhat similar experiment practically the same results were obtained."

Two very interesting questions are suggested by these ex-

periments : (1) how the air which distends the pleural cavity is disposed of, and (2) how the lung once collapsed again expands. In reference to the first question, Ewald and Kobert assert (*Op. cit.*), "The lung is for the usual pressure in life, not air-tight, but permits the air to pass both into the pleural cavity and blood-vessels." If this is so, why, under the suction of expiration, may it not pass back again into the circulation? Absorption is evidently aided by the conditions present.

W. Einthoven (Note : *Archiv. f. d. ges. Physiologie*, etc., 1889, XLIV., p. 152) reports results of experiments upon intra-thoracic pressure and the gas-tension of the pleural cavity. He says, "The intra-thoracic pressure remains negative throughout life, although the fluid which moistens the pleura is brought in contact with the air constantly through the lymph and blood."*

Einthoven shows with what rapidity in a favorable case may the air forced into the pleura be absorbed. Oxygen may be absorbed in several hours according as its volume corresponds to the oxygen tension of the pleura. In this time the carbonic acid has been excreted. Afterward the composition of the gas mixture remains constant, and the further rapidity of absorption depends upon the rapidity with which the most slowly absorbable gas, nitrogen, is taken up.

* "A separate pressure for each gas constituent of the air absorbed into the fluids of the organism (in the pleural cavity) is not apparent, but only the combined pressure ; because the oxygen is diminished by chemical combination, while the carbonic acid is not produced in corresponding proportion. The sum of the tensions of the three gases is less than the atmospheric pressure."

He experimented to determine the tensions of these gases. At the same time he investigated the rapidity with which the introduction of a gas into the pleura reduced its pressure by the absorption of the gas ; and too low a pressure was brought to normal by the exhalation from the pleura and pleural fluids. His conclusions are : The experiment explained the existence of pneumo-thorax with high positive tension in the pleural cavity. The usual cause as given for the pneumo-thorax of high positive tension in the closed pleura is that the gas penetrates into the cavity and exudation takes place, and that the volume of the exudation compresses the gas. But the formation of exudation is insufficient of itself to maintain a high gas tension for any length of time ; the increase of the gas tension in the pleura, perhaps the gas tension of the exudate, is the cause of a higher intra-thoracic pressure which remains for several days.

The increase of the total sum of gas tensions in the diseased pleura is only to be ascribed to the increase of tension of the carbonic acid. He does not attempt to explain this increase tension of this gas. The exudate itself plays a very subordinate part in the absorption or excretion of gases.

The rapidity of absorption in the human pleura corresponds with the clinical observations.

To me it seems very probable, as already explained in O'Dwyer's experiment, that the compression of the air contained in the pleural cavity by forcible expiration and by the cough usually excited may help to disintegrate the gases and favor their expulsion from that sack.

The answer to the second question is, if possible, more difficult to give. That is, how does the atalectic lung, whether induced by the pressure of an empyema or an accidental pneumo-thorax, sometimes expand even when the chest wall on that side is freely opened? Of course, the solution of this problem serves to answer the first question already disposed of; for if the chest wall be not perforated, whatever there is of the remaining forces of inspiration and expiration can have full play. But with the thorax opened on one side, the intricacy of the subject is wonderfully increased; for we do not know how a flaccid organ like the lung can be so constructed as to open itself. Speaking of one lung as separate from the other, this opening up of a collapsed lung is impossible, and Dr. Northrop's experiment of introducing a canula in both pleural cavities, before described, proves this impossibility to my way of thinking. We must look to the natural working of some remaining unaffected lung tissue for an explanation of this phenomena. This throws in doubt all the explanations of it I have thus far noticed.

Let us look into this subject a little further, bearing in mind all the time the natural contractility of the elastic lung tissue. This is the inherent power of the stretched pulmonary tissue, which never rests from the time the infant draws its first breath till the lung becomes useless from disease or the death of the individual. This elastic power of the lungs is variously estimated by different authors. It is usually measured by the resistance offered to the entrance of air, which is said to average one half pound to the square inch. On the other hand, according to Draper, the counter-acting pressure, as represented by a forcible inspiration, is equal to one pound to the square inch. If this estimate of forcible inspiration is correct, we can understand that ordinary inspiratory force exceeds the elastic contracting power of the lung by at least less than the equiv-

alent of the latter ; and that the inspiratory power has to be weakened but a very little, whether by obstruction to the entrance of air through the air passages or by the feebleness of respiratory muscles, to account for the collapse of the lung. But this expected collapse does not always occur, even under such favorable circumstances as where an opening from the external air is made into the pleural cavity ; and still oftener exceptions may be noted where an opening from the pleural cavity is made into the lung, as in an accidentally produced pneumo-thorax, due to perforation of a lung by a broken rib.

Dr. Joseph O'Dwyer, in a paper on Atalectasis in the New York *Medical Journal* for March, 1889, refers to the solution of this problem as follows : " Dr. Samuel West, of London (Note : *British Medical Journal*, August, 1887), by a series of ingenious experiments, has demonstrated that this force is the normal adhesion or cohesion between the opposing surfaces of the pleura, and that it is not only sufficient to counteract the elastic power of the lungs, but considerably exceeds it.

" In other words, atmospheric pressure operating through the air passages, together with this adhesive force, is greater than the same pressure on the outside added to the contractility of the lung. With normal inspiratory power, therefore, collapse will not occur when the cavity of the pleura is opened, but if this power be considerably reduced by shock, resulting from the injury, the reverse will occur, which explains the fact that the lung does not always retain its position under the circumstances named."

Dr. O'Dwyer, in objecting to the above, continues, " Atmospheric pressure on the inside, as before stated, can do no more than balance the same pressure on the surface of the lung. The opposing surfaces of the pleura are widely separated and the force of normal adhesion is lost. There is therefore nothing left to overcome the elastic power of the lungs, which in the adult has been estimated as equal to lifting a weight of 150 pounds with every ordinary inspiration.*

* " To this must be added the resistance offered to inflation by the coating of fibrin on the visceral layer of the pleura, and the condensation of the lung and consequent interference with its nutrition resulting from the compression, which do not exist in ordinary atelectasis. It is certain that all these obstacles to the re-expansion of the lung are finally overcome, but to explain the process by

"Turning now to the functions of respiration for a possible solution of this problem, we naturally think of the energy developed by the diffusion of gases, but this is probably not very great, and even if so, would not aid inspiration any more than expiration, while it is an exclusively inspiratory force that is required."

"The only other theory that has occurred to me," O'Dwyer says, "and apparently the only one left, is the assumption of an attraction between the hæmoglobin of the blood and the oxygen sufficiently powerful to operate at a considerable distance, similar to the attraction of the magnet for its keeper; otherwise it would accomplish very little, as the smallest bronchial tubes are surrounded with elastic fibres, and being devoid of cartilaginous support, collapse with the rest of the lung, thus keeping the air at some distance from the alveoli. There are several physiological facts that tend to sustain this theory."

For my own part, I cannot see my way definitely enough to accept Dr. O'Dwyer's explanation as conclusive. Very likely, I am not physiologist enough thoroughly to comprehend it, without the aid of the "physiological facts" mentioned. That the explanation is fundamental, and, as Dr. O'Dwyer

which it is accomplished, theories only are available and none of them satisfactory.

"The theory that the lung is drawn toward the ribs by the contraction of cicatricial adhesions is untenable, because adhesions do not always exist in the beginning, and before they can form, the visceral and parietal pleura must be brought in contact, which requires considerable expansion of the lung to fill the intervening space. It may also be claimed that the opening in the pleural cavity is smaller than that of the larynx, and that the pressure on the surface of the lung is therefore less than in the interior, because air cannot enter so rapidly to fill the partial vacuum produced by inspiration. The objection to this theory is found in the fact that a free opening gives better results than a small one, and also that air entering through the natural passages has a much greater distance to travel, and the time and increased friction give the advantage to the short direct passage between the ribs, even though it be the smaller.

"The same arguments are applicable to the valvular form of the opening, whether it be produced by the dressing or otherwise, provided it admit any air at all. Any considerable distension of the lung from congestion which occurs in ordinary atelectasis is prevented by the pressure of the air on its surface. The recoil of the condensed air from the sound lung during the act of coughing, while the glottis is still closed, appears to me to be the only force connected with the mechanics of respiration that is left. It is quite probable that this accomplishes something in starting the process of dilatation, but the effect is too transitory and too infrequently repeated to do more than this."

intimates, has to do with the function of the lung, I have no doubt ; but is it not quite possible, in some of these cases, that the elastic power of pulmonary tissue (which in the beginning we resolved not to lose sight of) has been temporarily suspended or lost through *non-use ?* That is, the law which applies to lung tissue when once distended cannot apply to that from which not only the reserve, but the residual air is all expelled. Thus I can see that it is possible for this elastic power of lung tissue to be so weakened, the same as muscular tissue elsewhere may atrophy from loss of use or function, that even less than the usual intra-thoracic pressure may cause the air to re-enter the atalectic lung, and awake the dormant functioning power to at least a partially normal state.

If this is so as between a healthy and collapsed lung (and I have already intimated that healthy elastic lung on one side is essential to the reopening of atalectic lung on the other), then why not as between contiguous healthy and collapsed lung tissues ?

Is it not quite possible that the refunctioning of even a lobule, once collapsed, may help to reopen its neighbor, not only to the entrance, but to the renewed use of air ?

Is it not also possible that the occurrence of emphysematous patches around pulmonary cavities or cicatrices, in those who have arrested consumption at high altitudes, as remarked by Dr. C. Theodore Williams and others, may be explained in a similar manner ? That is, that the air cells which through closure due to non-use, or through pressure due to congestion, had lost their elasticity, when reopened had not again their natural resistance to inspiration. These weakened cells thus give way to greater intra-thoracic pressure, induced by cough or dyspnœa, and especially by high altitudes.

It is certainly possible that there is a *common* cause for emphysema, or bronchial dilatation and atalectasis, either alone or associated with fibroid thickening—so often are these several conditions found to be associated ; and that, too, in such variable degrees as not to be easily accounted for on any entirely separate or distinct causation.

The near relation of the fibroid process and atalectasis is almost too patent to need explanation, and I will simply refer to the remarkable deformities of the chest in children follow-

ing pleurisy with effusion, bronchial-pneumonia, etc. I have in several instances accounted for a depression of the left infra-mammary or lower axillary space by the fact that the nurse or mother had carried an infant, during or after an attack of broncho-pneumonia or bronchitis, with her left arm around the child's waist. The habit of so compressing the child's chest, under such conditions, had closed the air cells, and there was too much adhesive inflammation there to permit the air again to enter, in preference perhaps to over-distending the other or healthy lung.

Did time permit, many other interesting features of atalectasis could be introduced as to both etiology and treatment. As to the latter, I will refer to the management of the fibroid process, already described, and to the utility of an active life in a climate of lessened atmospheric pressure, as quite as applicable to this as to that form of lung collapse. I will, however, mention two methods of treatment especially calculated to reopen the atalectic lung.

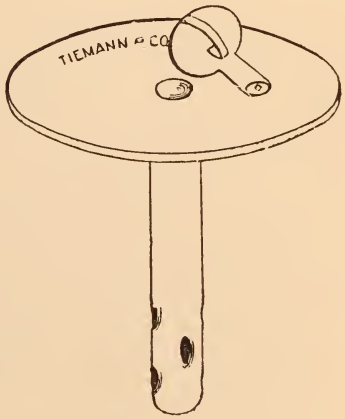
First: Where for any reason suitable exercise cannot be had at a sufficient elevation above sea-level, like riding horseback and climbing hills (which we will say is preferable, because it is the most natural), the use of a pneumatic cabinet can be tried with advantage. This inhalation of the outside air, while one is shut within this instrument, with the atmosphere around his body rarefied, is calculated to draw the air into the collapsed cells. If the sides of the air cells are not permanently adherent, this force should reopen them. The refunctioning of the previously atalectic lung and the reoxygenation of the blood therein, I believe, are processes in the cure, as I have tried to explain. I have been in a pneumatic cabinet at about sea level, and I will say that, after breathing there but a short time with the air around me rarefied to the equivalent of a depression of one and one-fourth inches of mercury, I felt very much as I always do, with chest full and high tension pulse, when I have climbed a hill in the Rocky Mountains.

Second: The other method of management to be described refers to that class of cases where the whole or much of a lung has been compressed by empyæma, or hydro-pneumo-thorax, or where such atalectasis is sought to be prevented from occur-

ring after opening the chest wall, as in draining pulmonary cavities.

Without any knowledge of Dr. Northrop's experiments on dogs, previously mentioned, but incited thereto by a conviction of its need, on account of the dyspnœa and shock following operations for drainage of pulmonary cavities, etc. (and nearly all chest operations with me have been for complications of phthisis), I had Tiemann & Co. make the *valvular drainage tube*, which I here exhibit.

It is made of soft rubber, with round point and velvet eyes, so as not to injure or irritate the interior parts. The shield which supports the tube is intended to be broad and flexible enough so that, as it lies against the chest wall, it will prevent the entrance of air around the tube. However, it is desirable to make the opening through the chest wall only just large enough to receive the tube.*



The tube's external orifice is covered by a movable, very delicate, thin platinum valve, which can be swung to one side for the purpose of injecting the cavity. This valve is intended thoroughly to close the opening against the entrance of air, yet be so flexible that the increased intra-thoracic pressure, due to cough or forcible expiration, will force out the contained air or fluid. The result is that the air is all the time being pumped into the atalectic lung through the exaggerated mechanism of breathing. It is intended that the patient of his own motion can, by straining to increase intra-thoracic pressure, force the air or pus out of the tube; but by no effort of his own breathing can he draw air back through the tube into the pulmonary cavity. If the construction of the tube is not so perfectly adapted to the case in hand, suitable padding over the shield and a film of cotton over the valve can be used

* See article on "A New Rib Cutter," etc., *Journal of the American Medical Association*, March 15th, 1890.

underneath the retaining bandage, so as to accomplish the object sought.

It is conceived that thus the aid to inspiration, through the traction of the pleural surfaces, normally in opposition to each other, is in a measure restored. However little this aid may be, it is probably enough, in addition to the inspiratory force, to overcome the feeble tension of the collapsed lung, which is perhaps only due to the apposition of the opposed interior surfaces of the air cells.

III. AND IV.—ASTHMA AND EMPHYSEMA.

I trust you will forgive me for treating these two subjects under one head, and thus, for want of time, doing purposely what most authors do carelessly. For they even seem to "steal the thunder," so to speak, of emphysema, and give it to asthma, or *vice versa*, according to whichever subject they choose to write upon. Emphysema appears to have been the "under dog" in the fight, so much hitherto has asthma occupied the whole field.

One could write a large book on asthma, as both Berkart and Salter have done, giving in lucid detail the various ideas of authors, and experiments as to the inspiratory and expiratory, the humeral, the paralysis, and the neurotic theories of causation, with symptoms and cases to substantiate their different beliefs.* Indeed there are so many diverse phases both of disease and of opinion to be described, it is a wonder that there is anything else than confusion in the medical mind as to this malady.

When one contemplates the contradictory descriptions from distinguished authors, as given by Berkart,† he cannot help being reminded of the lines of Burns :

* "Bronchial Asthma," by J. B. Berkart, M.D., J. & A. I. Churchill, London ; "Asthma : Its Pathology and Treatment," by Henry Hyde Salter, M.D., F.R.S. New York : William Wood & Co.

† "Bronchial Asthma," by J. C. Thorowgood, M.D., W.R.C.P., London, 3d ed., p. 18.

"Respiration retarded from 9 to 7 per minute" (Salter).

"Inspiration is difficult ; expiration short, easy, superficial" (Bergson).

"The lungs are usually collapsed within the thoracic cavity, and the parieties drawn in" (Williams).

"Respiration augmented to 40, 60 to 80 per minute" (Canstatt, Ferrus, Wunderlich, and J. C. Thorowgood).

"It's hardly in a body's power
To keep at times fra being sour
To see how things are shared."

In our own Association it is doubtful if there is any subject, not even excepting the superior utility of high altitudes in the arrest of phthisis, upon which there is a greater variety of opinion than upon this question—the nature of asthma. So when no less distinguished an authority than my good friend Dr. C. Theodore Williams,* of London, uses the expression, in explanation of the atrophic process, which occurs around pulmonary cicatrices in arrested phthisis, "This substitution of *emphysema* for lung decay eventually converts phthisis into habitual *asthma*, with its signs of tympanitic stroke—sound and wheezy *dyspnœa* and cough," I feel as though some one ought to exclaim against the synonomous use of these terms, emphysema, asthma, and dyspnœa. I fancy this variance of medical opinion is anyway chiefly due to the confusion and misapplication of terms, which faulty methods of description involve. Take, for instance, a good average definition of what asthma is, as given by Dr. Geddings in his article on the subject in Peppers's "System of Medicine." "A violent form of paroxysmal dyspnœa, not dependent on structural lesion; characterized by wheezing respiration, with great prolongation of expiration, and by the absence of all symptoms of the disease during the intervals between the attacks."

It seems to me there is not a clause in this definition, unless it be the last, to which there is not some reasonable objection. The condition need not necessarily "be violent," it cannot long exist without producing "structural lesion," and "prolonged expiration" is much more distinctive of emphysema than of asthma.

Perhaps it would be better to ignore authorities and get at the matter in some new way. Allow me to suggest the fol-

"The chest remains distended, its walls are kept fixed in the extreme inspiratory position, such enlargement involving all the diameters of the thorax" (Salter).	"Expiration is mainly impeded, the patient labors 4 to 5 seconds to empty his chest" (Biermer).
"Thorax sounds dull on percussion" (Williams).	"Percussion induces a hyper-resonant note" (Biermer).

* "Pulmonary Consumption," 2d ed., by C. J. B. Williams, M.D., LL.D., F.R.S., page 107.

lowing definition of bronchial asthma. It is *a neurosis producing a paroxysmal dyspnœa, due to irritation "in loco," or of the pneumo-gastric nerve, causing contraction of the circular muscular structure of the bronchial tubes, thus limiting inspiration chiefly, but also expiration; and eventuating (if prolonged) in structural change in either one of or both the vesicular or bronchial portions of the lung.*

It does not so much matter from what source the irritation comes, whether from the lining membranes of the tubes themselves, or from points at a distance from these tubes, as in abnormal states of the gastric or Schneiderian mucous membranes. The limiting of the disease to a *neurosis* is conclusive as to its nature; and as to the power of contraction in the bronchial tubes, or the control of that power being exercised by the pneumo-gastric nerve or par-vagum, these are matters of fact which seem to me to have been conclusively shown by undoubted authority. As long ago as 1840 Dr. C. J. B. Williams demonstrated the contractility of the bronchial tubes under electric irritation of the vagus nerve, and his conclusions have since been confirmed by Longet, Volckmann, Wintritch, Paul Bert, L. Gerlach, and H. MacGillivray.*

Longet † not only confirmed Williams's discovery, but added the evidence that section of this nerve, the pneumogastric, caused even emphysema, thus showing the annihilation of the elastic power in pulmonary tissue.

While Wintritch said that he saw the bronchia contract, and MacGillivray demonstrated that the contracting power was a great deal more than the manometer, as usually used, could indicate.

Emphysema we will define as *the over-distention of the lung with air beyond the limit of its normal expulsion.* This term applies whether it be the smallest bronchial tubes, the air vesicles, or the inter-lobular spaces which are affected; the vesicular variety, including the terminal twigs of the bronchial tree, being usually meant by the term emphysema. It is of importance to note here the near relation of bronchiectasis, or dilatation of the bronchial tubes, to this emphysema; and to state that to constitute the latter condition, the increase in

* J. C. Thorowgood, *Op. cit.*, p. 13. † J. B. Berkart, *Op. cit.*, pp. 12–15.

the amount of air in a part need not always be an *absolute* increase, as in the usual hypertrophic form, but may also be only a *relative* increase, as in the atrophic variety, often locally found in arrested fibroid phthisis.

Both of these conditions, then—asthma and emphysema—are or are equivalent to an increase in the intra-thoracic pressure under conditions which are peculiar to each disease. Why not allow these peculiar conditions to determine the di viding line between the diseases ; and as chronic cases necessarily become mixed in character (see *résumé* of my own cases to follow), call such complicated cases asthma-emphysema, or emphysema-asthma, according to whichever of the two predominates in a given case.

It is instructive to place these two diseases in apposition to each other as in their action.

Asthma.	Emphysema.
Asthma is a neurosis, and unaccompanied by structural change of tissue in its initiation.	Emphysema is not a neurosis, but depends upon structural change for its existence.
Results in more or less emphysema in all severe or protracted cases.	May be caused otherwise than by asthma, as by an unusual strain in lifting, laughing, whooping-cough, or prolonged bronchitis.
Is a purely spasmodic affection.	Is more or less continuous.
The intra-thoracic pressure during the attack is always above the normal for the individual.	Less than normal pressure may suffice as a cause through the weakening of the tissue by disease, or the more or less complete abolition of elastic tension in the part of the lung affected.
Has a tendency to return, but depends upon its peculiar cause for its return.	Is continuous, but having exacerbations from slight causes, *i.e.* whatever will temporarily increase intra-thoracic pressure.
Produces marked deformity of the thorax, at first temporary, in which the elevation	Produces more marked deformity of chest and of a permanent nature, in which

of the shoulders, the expansion of the summit, and retraction of the base of the chest and of the abdomen, are the usual characteristics.	the stiff barrel-shaped thorax, antero-posterio cervical curvature, rigid protruding sternum, and usually distended abdomen are the characteristics of the severer forms.
The feeling of the constriction of the chest is alarming, as of impending asphyxia.	The dyspnœa is less alarming, but more persistent, and with feeling of over-distension of the thorax.
Inspiration is particularly difficult, the induced difficulty of expiration being a secondary result.	Expiration is particularly difficult and prolonged, inspiration not being much interfered with, except asthma complicates the condition, and because the vesicular portion of the lung is already too full to receive more air.
The respirations may be greatly increased in frequency.	They are often lessened.
During the paroxysms the venous congestion is very marked indeed, indicating interference with both the blood and air circulation in the lung, which is perhaps as good a measure of the intra-thoracic pressure as we have.	Venous stasis is usual, but not so marked, and depends upon the extent of underlying lesions and their hindrance of normal action. Hence the worst cases, indicating venous stasis and abnormal intra-thoracic pressure, are found where the two conditions are associated in the same individual.

I do not intend to go farther than this table does into the clinical history of these affections, and it is impossible for me now to cover the whole ground of their pathology and treatment.

The following *résumé* of my own cases will serve as a warrant for the views expressed. They were intended to include, but probably do not, all the cases of asthma or emphysema to be found in my records. That this list of fifty-four cases includes only about one in fifty of these, and presents the large number of 147 complications, I ought to explain as due to my own perhaps peculiar method of trying to give to each separate

condition found its due weight in the recorded diagnosis ; and also to the fact that very few primary cases of asthma call upon a physician for a physical examination in Colorado, though hundreds of this kind are constantly coming to the Rocky Mountains. There were some of my own cases that were of this character that were not recorded at all. Generally such persons as have come "for the climate" begin to feel better on the way or on arrival, and when getting well naturally conclude that a doctor is the last fellow they want to see.

Upon thinking the matter over, I have no doubt but that there are a number of my cases which ought to have been included in this list which have not been found. For instance, I have looked up the case of Dr. H. B. Scott, a young physician in the United States Navy, stationed in the Naval Hospital, Brooklyn, who came to Denver about March, 1889. His was a peculiar case of sub-acute tuberculosis and emphysema of right lung, with annihilation of use of right lung, probably through caseous deposit around its root. I was sure the case was tubercular, because bacilli had been found in his sputa. His afternoon temperature was 102° or over, and he had contracted the disease, having no inheritance to it, during a protracted microscopical study of tubercular sputa in the Marine Hospital at Brooklyn, N. Y. On my first examination I found him in a pitiable condition, weak, emaciated, and the least exercise caused dyspnœa. A harassing cough sometimes caused him to vomit. The usual to and fro respiratory sounds, the modifications of which help so much to fix the diagnosis in other cases, were displaced by the mixed drum-like sound of the stagnant and undoubtedly poisoned air pent up in the right lung. This emphysema was at the base, while at the apex of the right lung there was undoubtedly some considerable deposit and suspicions of commenced breaking down of lung tissue.

After living at a private resort in North Denver a couple of months, there was considerable improvement shown. At times he stated he had expectorated "chunks" and then breathed easier afterward. At the second examination there was less fever afternoons and condition generally better. Air entered the right lung better, giving moist rales at end of forced inspiration around right base.

June 14th, 1889. Evening temperature, 99.6° ; morning, 98.4°. Had felt worse during storms, but generally doing pretty fairly. Was still sleepless, and sometimes vomiting had been caused by cough. Air entered right lung, but in a restrained way. High pitched expiration, with slight "crack-

ed metal" in outer portion of the right infra-clavicular space, and there were a few rales on right side. The spirometrical record and expansion of the chest (now 32¾ and 35 inches) had increased somewhat at each examination, probably a great deal through the supplementary expansion of the left lung.

After this Dr. Scott went to Perry Park, Col., to spend the summer, and astonished every one by his improvement.

July 11th, 1890, another patient of mine writes from Perry Park, "Dr. Scott arrived here about two weeks ago, looking so well nobody knew him. He has just returned from a six hundred mile ride into Mexico, where he went with a party of Detroit gentlemen, who were after mining property. He looks in perfect health, although he still has some cough, but practically he is a well man in comparison with me. He thinks of going to El Paso and taking a trip to the Sacramento Mountains."

Whole number	54		
Average age	37		
Males	47		
Females	7		
Total number complications	147		
Number in which asthma was diagnosed	37	Approximate per cent,	.69
Number in which emphysema existed	33	" "	.61
Number in whom either bronchitis or bronchiectasis was found	27	" "	.52
Number in whom fibrosis was noted, either peribronchial or peripheral	34	" "	.63
Decidedly tubercular cases, temp. 101° or over	7	" "	.13
Complicated with pleurisy	3	" "	.6
Having valvular lesions	4	" "	.7½
Hæmorrhagic tendency marked	1	" "	.2
Laryngitis marked	1	" "	.2
Worse in Colorado	6	" "	.11
Stationary	9	" "	.16½
Improved	20	" "	.37¼
Decidedly improved or wholly arrested	19	" "	.35¼
Average time lived in Colorado	2 yrs.		

I will not stop to attempt the explanation of the coincidence of their being so small a proportion of females to males, but here give in tabular form the complications noted

I ought to state that about six sevenths of these cases were seen but once, and that the estimate of their retrograding or improvement had to be made at the last examination and for the time they had severally lived in Colorado, which in this list averaged a little less than two years. The ages of these fifty-four persons averaged thirty-seven years, and there were forty-seven males and seven females.

All of the "worse" cases, and all but one of the "stationary" had more or less marked emphysema, and some of these were advised to return to a lower level. Only one of these cases had even a doubtful origination in Colorado, and that was a peculiar form of emphysema, and is herewith appended (see case 3).

DENVER, COL., April 21, 1890.

Case 3. T. D. R., 31, male, single, clerk, lives now in Date, Col., 10,000 feet above sea-level. Been in Colorado nine years. His twin brother died of consumption. Said he never had any lung trouble before coming to Colorado, yet at the age of twelve he was struck in the chest and ever since in hot weather has had dyspnœa. I think he must have had some asthma, complicating his condition, because when living in Denver, 1883 and 1887, he would sleep better and be relieved of his dyspnœa in Golden, twelve miles distant, breathing always better up in the mountains until lately. A month ago came down to Denver, took cold, and had something like la grippe. His cough was tight, and he supposed it settled in his left lung. Had a constant pain there for three weeks, and was feverish at times. Nothing has helped him since, and his dyspnœa is worse up in the mountains. Excitement causes cough and expectoration. Appetite good, but bowels constipated ; sleeps poorly. Spirometrical record, 192. Height, 5 feet 8½ inches. Hurts his left lung to use spirometer. Pulse, 72 ; respiration, 16 ; temperature, 98°. Bulging left mammary region. Movement, left, 18 and 18½ ; right, 17 and 17½ inches. Right empties itself with expiration, but left does not unless aided. Left superior portion gives tympanitic percussion sound ; respiratory sound feeble (almost none) unless forced, and expiration is prolonged.

Diagnosis, recent vesicular emphysema, left ; old trouble may have been asthma-emphysema. Gave iodide of potassium, with alterative doses of mercury, and directed a systematic use of the emphysema jacket, or lung compressor (1st trial

made). He writes me five weeks later, "I used the apparatus once a day, and think I derived considerable benefit from the exercise. I am now feeling better, have no trouble in breathing, and the pain has left me."

Taken as a whole, with so many and serious complications, the results were remarkably good, showing seventy-two and a half (72½) per cent more or less improved. Of course it was a matter of experiment how some of these people would get on. Many cases of emphysema complicating asthma did well afterward, through the improved ventilation of the lungs, due to the relief of the asthma; but up to the time of examination, the more emphysema predominated in these cases the worse was the effect of the new high climate, as Case 4 herewith appended illustrates.

This young man had seen many physicians and had his asthma since the age of five years. Did not know what emphysema was, and yet I confidently believe his was a case more of emphysema than of anything else.

Case 4. C. H. S., single, cabinet-maker. Warren, Mass. No inheritance. Had a humor when three and four years of age, and was broken out on hands, feet, and body. This disappeared, and then he had dyspnœa. Has had asthma for twenty years.

Yellow expectoration at times for ten years. Expectoration in warm weather sometimes one half pint a day, now a teacup full. Had measles four years ago, pneumonia three years ago, and la grippe last December. Arrived in Colorado six weeks ago. Says he does not feel elevation, but has not yet improved. Complains of being sleepy, and looks somewhat cyanosed; his chest heaves on inspiration. Burns Powers's Specific for his asthma. Weight now 114, was 122 last winter. Sleeps poorly; appetite poor, but bowels usually regular. Pulse, 104; respiration, 24; temperature, 99°, 3 P.M.

Spirometrical record, 86 cubic inches. Height, 5 feet 6 inches. Chest barrel-shaped, much deformed, and inflexible. Expansion only 34½ and 35 inches. Inspiration short, and expiration prolonged, ratio 2 to 4, especially noted at left infra-clavicular, right infra-mammary and infra-scapular, and left lower axillary regions. Exaggerated voice both infra-clavicular regions, greatest movement right apex, least right bases behind, where very little air enters. Bronchial rales in spots and mixed percussion sounds generally. Diagnosis, emphysema, asthma, broncho-fibrosis, and chronic catarrhal-bronchitis. I do not know that any less title would do this case justice.

Taking the hint from an answer he gave—that is, that he was once on the ocean and breathed well, I directed him to go 2500 feet higher up, to Idaho Springs, for from one to five days, and stated that, if he was not improved, he had better go East and go to sea. I also had him temporarily use the lung-compressor, always with the effect of compelling him to expectorate profusely a muco-purulent sputa.

The young man went to Idaho Springs, as advised, but returned at once, stating "he could not stand it." This confirmed my diagnosis as to emphysema in his case, and as to the advisability of his going East. From his home he writes me July 1st, "You would be surprised to see me since my return; the swelling has all gone from my face and feet. My strength is coming back to me. I harness and take care of the horse, run a lawn mower, and do much out-door work. I still have some cough, yet it is better than while in Denver, and my asthma, I think, is lightened by my trip."

The conclusion which our investigation admits of with reference to high-altitude climates relieving asthma, is a very favorable one—namely, that simple or primary cases are very decidedly benefited or cured, while in cases that are complicated with emphysema the chances of benefit are favorable enough to warrant an experimental trial in nearly all such instances; the exceptions being where the emphysema is very marked or there are serious complicating valvular lesions.

There has never been, to my mind, any better explanation of the *modus operandi* of this relief of high-altitude in asthma than that based on the increased intra-thoracic pressure due to the greater amplitude of breathing induced. The greater quantity of air which has to be breathed to furnish the required supply of oxygen distends the bronchial tubes and stretches the circular muscle fibres beyond their capability of spasm. Thus, the congested or impeded pulmonary circulation is supplemented by a natural flow, following the return to natural intra-thoracic pressure during inspiration and expiration. Cases 5 to 8, following, are fair illustrations of this class.

DENVER, COL., August 27, 1885.

Case 5. G. A. S., male, 33, married ten years, laborer. Canada. Father and one cousin on his side had asthma. Asthma set in five years ago with a dry, hacking cough. Two years ago last January came to Colorado, and at first felt elevation, and then "his breath was better." Was better still when he went up to Webster and began to climb hills. Was

up there (about 8000 feet) eight weeks and had no asthma there. Before coming could not sleep in bed one fourth of time, sat up in chair nights. Weight in health, 150; when he came to Colorado, 118; when three months in Colorado, 159. Then went back East; began to feel badly after crossing the Missouri River. Had to sit up second night after reaching home. Brought his family out and lived in North Denver. After ten weeks he went to the mountains and got well again. Then last April had rheumatism, and went East. Asthma returned a week after he reached Canada. In nine weeks returned to Colorado. Does not gain so much this time; is weak and has to walk very slowly. Has a cough, but no asthma. Expectoration profuse. Been back six days. Bowels constipated, sleeps fairly. Appetite very poor. Pulse, 100; respiration, 26; temperature, 9 A.M., 100°; spirometer, 150; height, 5.6½; weight now about 125. Expansion, 33¼ and 35½. Both infra-mammary regions much sunken, and little if any movement there. Dulness left apex—in fact, slight all around the periphery of both lungs. There is tympanitic resonance in the centres, especially in scapular regions. On coughing sonorous râles and few bronchial râles. Broncho-vesicular respiration at left apex and around apices rear if breathing is forced. Inspiration and expiration about even in time.

Diagnosis, asthma, and first stage fibrosis, with catarrhal bronchitis.

DENVER, COL., October 23, 1885.

Case 6. A. A., nine, male. Cleveland, O. Father has hay-fever; this child has had glands affected and was sickly in infancy. His eyes are sore and he is scrofulous. Since going in swimming last summer he has had asthma. Had a cough in Cleveland. Came to Colorado a month ago, and has had no asthma since; usually had to sit up half an hour (in Cleveland) on going to bed, he "wheezed" so badly. Infra-mammary spaces sunken somewhat. Chest asthmatic in shape. There is harshness on forced inspiration, right infra-clavicular breathing generally harsh and somewhat "wheezing" in character, if much forced.

Diagnosis, asthma, now arrested, and scrofulous habit. Gave Fry's Emulsion. He went out to live on a ranch and was apparently cured. Is now living in Denver. No asthma.

DENVER, COL., December 28, 1882.

Case 7. Mrs. S. L. F., 54 years. Ottoville, Mo. Married 32 years, had eight children. Her mother and uncle had asthma. There were eight brothers and sisters, and no others had asthma. Well until 35 years ago, when she first had

asthma from exposure in cold air. In 1853 asthma became serious, and she then spat blood. Several times has had broncho-pneumonia. Sometimes rusty sputa with fever during these attacks. Bronchial tubes said to be affected in 1861. Was gradually worse till 1865, when she had asthma about one third the time, for fifteen years. Came to Colorado in 1871. Had several attacks here, but they gradually lessened in frequency, and she has been freest from them in Estes Park. Had no attack for a long time, until coming down to Denver, October 17th, from exposure had a very severe attack, rusty sputa, etc., from which she is just recovering. Weight when she same to Colorado, 110. Before this last attack, 171. Pulse, 80; respiration, 84; temperature, 98⅜°, 11 A.M. Chest barrel-shaped, and much the largest at base and behind. Bronchial respiration and scattered sonorous and sibilant râles. Expiration 3 to 5, to inspiration 2; greatest difference base rear. Tympanitic resonance infra-scapular spaces marked, and slight dulness at apices front and rear.

Diagnosis, asthma combined with emphysema, resulting in chronic bronchitis and bronchiectasis.

DENVER, COL., February 21, 1887.

Case 8. W. H. D., male, 19, New York City. Student and clerk. Mother and an aunt had asthma and bronchitis all their lives; three children; two died, at one and a half and five years. Catarrh at 13, and pneumonia at 16, and twice when 17 years of age. Asthma when 6 years old for two years in Massachusetts. Was then well eight to thirteen. Always had asthma when he would take cold. Always had "real asthma" when he would go to New Rochelle. When 18 went to White Mountains in summer, and winter before that to Bermuda, and winter previous to coming to Colorado had colds. Came to Colorado last of October, 1886. Did not feel elevation and has not had asthma, except during a bronchitis. Was taken down with measles three weeks ago. Now bowels constipated. Is sleepy, appetite fair; weight, 120; two years ago, 106. Pulse, 86; respiration, 22; temperature, 98°, 11 A.M. Spirometer, 210; height, 5.5; expansion, 30½ and 33½. Dulness slight right extreme apex. Broncho-vesicular respiration there; and rear inspiration 2 to expiration 3. No râles, but harsh breathing over bronchia; less movement on right than left.

Diagnosis, asthma, with broncho-fibrosis, first stage. Have seen him this year, 1890; he looks and seems well.

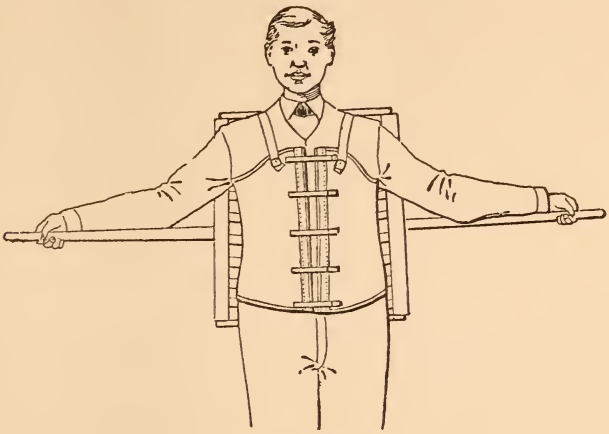
With emphysema, however, the conditions for treatment are entirely different. The intra-thoracic pressure, already beyond

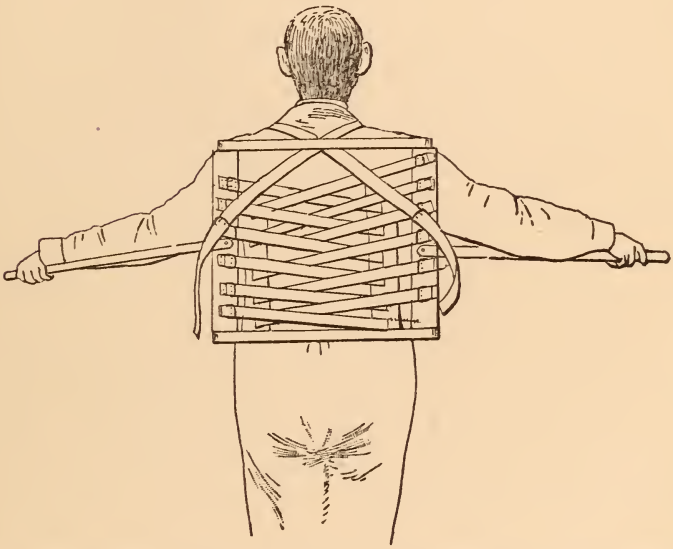
the control of the delicate walls of the air cells, is at last opposed by the inter-cellular and inter-lobular tissues and the capsules which contain the lungs, and even these are not sufficient but what chest deformity must occur from this augmented intra-thoracic pressure. If it were not for the fibroid process and newly formed elastic tissue, some cases would never stop progressing. It is as though two easily distensible rubber bags, one stronger than the other, were connected by a small rubber tube, after being blown partially full of air. The stronger will force the contained air into the weaker bag. However, if it were possible to construct the two bags of the same strength, but with a contracting capsule just like the lung tissue, and have one over-distended with air and the other not, then the larger could not force the air into the smaller, for the partly distended bag represents greater contracting power than the other. So it is with emphysema and high altitude. The increased intra-thoracic pressure induced in a rarefied atmosphere may crowd the inhaled air just where it is not wanted—into the already emphysematous portions.

It is a denser air, and conditions where as little air as may be will answer the requirements of the system, that are needed in uncomplicated emphysema. But emphysema is so seldom uncomplicated that the asthma which produces it, as before remarked, probably ought to have a first consideration as to the trial of a desirable high-altitude climate.

Before leaving this subject, I wish to describe a device I have had constructed for the self-treatment of emphysema. We will call it the Portable Lung Compressor. It was suggested to me by the "Rossbach Chair,"* which, in its mechanism and result, it much resembles. Its purpose is *the rhythmical and forcible compression of the chest in consonance with expiration.* The idea of assisting the expiratory movements of the emphysematous patient is not a new one, as before Rossbach invented his chair physicians (Gerhardt first) used to train nurses to compress the sides of the patient's chest during expiration ; and belts and other devices have been used to com-

* *Revista de Ciencias Medicas,* Barcelona. Translated by Dr. G. Cadogan-Masterman, in the *Provincial Medical Journal* of May 1st, 1888, and "Diseases of the Lungs," by James D. Whitaker, M.D., vol. I., 1889, *Sajous' Annual,* page 74.





press the chest. The results have been stated as generally favorable.

This lung compressor, or emphysema jacket, is supported and controlled by a simple nearly square frame, which can be hung against the wall, so that the patient can get into the jacket alone. This frame has for its sides pivoted, half round, elliptical beams, arranged so they can be pivoted at from one to three inches from their centres, thus giving greater compression as desired. To these bands are fastened by buckles, which bands are sewed to the opposite sides of the jacket, and

therefore cross each other at the patient's back. By their traction they squeeze the chest when the jacket is used. The compression can be made to suit any shaped chest, or any particular part of a given chest, by dividing the front lacings of the corset into three different fastenings, and by the adjustment which the posterior straps and buckles and the retaining shoulder straps permits. The power is ample, which is given by the side levers (attached to the middle of the side rollers), as they are moved forward by the patient's hands during expiration, and backward during inspiration.

In Rossbach's apparatus the chest was compressed backward against the back of the chair, while in this there is a more even compression of the thorax in all its parts, and this jacket can be used, not only in the sitting posture, but either lying down, standing, or even during exercise by walking. Of course, the great aim is to aid expiration. However, the movement backward of the arms during inspiration undoubtedly aids the act of breathing, not only by freeing the chest from the previous compression, but by the more natural position assumed for inspiration. The kinds of breathing it would seem best to practise with this device are slow measured inspirations with as complete emptying of the chest as can be comfortably borne, say twelve or fifteen breaths per minute, for as many minutes at a time, three times a day. I believe that a return of the normal resiliency of the emphysematous lung, and the clearing out of the muco-purulent contents of bronchial dilatations, can be favored by the systematic use of this apparatus. The few opportunities I have had of trying it (see cases 3 and 4) decidedly warrant this statement, and I trust any of you who try the Portable Lung Compressor will have the same experience.

I thank you, gentlemen, for bearing with me through so much of this study. There remains to be considered some extremely interesting phases of this general subject, among which are pulmonary hæmorrhages, pneumo and hydro-pneumothorax, the drainage of pulmonary cavities, and operations for different laryngical stenoses.

I am desirous of continuing this investigation with, I trust, a reasonable hope of accomplishing something in the drainage of pulmonary cavities, and perhaps furnishing a new operation for the relief of that most disastrous malady--membranous croup.

REMARKS ON THE PNEUMATIC TREATMENT OF DISEASE, WITH CASES.

By D. M. Cammann, M.D., of New York.

The use of rarefied and compressed air in the treatment of disease is no new thing, and its benefit in certain cases, more especially of pulmonary disease, is no longer open to doubt. In 1664 Dr. Henshaw, an English physician, proposed the treatment of disease by varying the pressure of the atmosphere surrounding the patient. Nearly two hundred years later, in 1820, Dr. Hamel, a Russian physician, made, near Dublin, the first observations of real value upon the effects of high atmospheric pressure, and these were followed, in 1836, by the experiments of Junod with compressed air. An impetus was thus given to the study of the subject, and numerous essays appeared, and institutions for treatment by this method sprang up in Europe. The patients were placed in chambers in which the air was rarefied or compressed. That the asserted results were even more brilliant than those claimed by present advocates is shown by the reports of Bertin. He recorded the cure of fifteen cases of uncomplicated emphysema ; and of ninety-two case of nervous and catarrhal asthma with associated emphysema, sixty-seven were cured, twenty-two benefited, and three unimproved. Later Waldenburg devised the apparatus which bears his name, and placed the pneumatic treatment of disease upon a more scientific basis. He considered the methods of inspiration of condensed air and expiration into rarefied air the most valuable.

Whether we can obtain the fullest benefit of treatment by air at varying pressures by use of the pneumatic cabinet only, or whether as good results follow with less cumbersome and costly apparatus by which is inhaled rarefied or compressed air, the body meanwhile being surrounded by air at atmospheric pressure, is open to some doubt. Solis-Cohen strongly

supports the latter view. In the one case the air that surrounds the body is compressed or rarefied ; in the other it is unchanged, while the air that enters the lungs is acted upon. Does it really make any difference which procedure we adopt ? The actual difference in pressure is a very small factor in the result, as it rarely exceeds that indicated by one inch of the column of mercury, a difference that is experienced almost daily with the fluctuation of the barometer. Dr. A. H. Smith* has shown that with an increase of pressure as great as fifteen or twenty pounds to the square inch no bad symptoms followed. Not until a pressure of forty or fifty pounds more were superadded were the brain and spinal cord engorged, or the possible introduction of nitrogen into the blood effected. Such being the case, we can scarcely conceive the slight condensation or rarefaction of the air experienced in the cabinet having much effect.

The important factor is the difference of pressure, the breathing in air that is relatively rarefied or compressed. That considerable rarefaction of the air surrounding the body would favor elimination by the skin, relieve venous engorgement and vascular tension in the kidneys and liver and permit the depurating function of these organs to be resumed I am quite aware, but that the amount of rarefaction that we usually make use of in the cabinet for a few minutes is sufficient to produce appreciable results in this direction seems to be open to doubt. The cabinet is undoubtedly well adapted to its purpose as far as mechanical working is concerned. By its use we can rarefy and compress the air with each respiration in a very satisfactory manner, so that the pressure over the thorax is removed with inspiration and the chest expands to its full capacity, while with expiration the air is compressed about the body and the least possible residual air left in the lungs. This is the act referred to in the following histories as respiratory differentiation. By inspiratory differentiation is meant the act of breathing the atmospheric air while that surrounding the body is rarefied ; and by expiratory differentiation is meant the breathing of atmospheric air while that in the cabinet is compressed.

In breathing air compressed relatively to that surrounding

* "Compressed Air," 1886.

the body the chest expands and takes in more air than in a normal respiration. But if we expire into the compressed air, the residual air remaining at the end of expiration is greater than after a normal expiration unless more than the usual expiratory force is used. The reverse is the case if we breathe rarefied air; the inspiration will not be so deep, and less residual air will remain after expiration than normal.* Further experiments are needed before we can say what are the exact physiological effects of the inhalation of rarefied and compressed air. Bartholow† says, "As inspiration of condensed air increases the intra-thoracic air pressure, it impedes the flow of blood to the right auricle and lessens somewhat the pulse rate. Inspiration of rarefied air has the opposite effect to those of condensed air." Rosenthal compares compressed air to digitalis in small doses, and says that it not only strengthens the circulation, but equalizes the two circulations, increasing tension within the left ventricle and lessening tension in the right. The inhalation of compresssed air increases the absorption of oxygen, promotes appetite and digestion, and increases the weight. The pneumatic treatment is of value as a gymnastic exercise for the chest. Its usefulness has been tested in dyspepsia, chronic bronchitis, phthisis, old pleuritic adhesions, asthma, etc.

Case 1. Miss A., aged 52. Bronchitis and pleuritic adhesions. December 3d, 1887.

The patient has been delicate for several years. Has a good deal of pleuritic exudation, preventing free expansion of the lungs, and occasionally has fresh attacks. Is troubled with nasal catarrh. Has had hacking cough off and on, especially in the winter. Is thin, rather anæmic, nervous, with appetite small and variable, and is easily nauseated.

She had treatment in the cabinet forty-one times, extending over a period of nearly six months. The treatment was pretty evenly distributed, except during the last two months, when it was less frequent. Each treatment began with respiratory differentiation, and was usually followed by inspiratory differentiation. At first she could not stand more than one-tenth inch on the manometer variation between extremes of pressure and rarefaction for about five minutes, and inspiratory

* "Physics and Physiological Action of Pneumatic Differentiation," Platt, *New York Medical Journal*, November 6th and 13th, 1886.

† "Materia Medica," sixth edition.

differentiation of two-tenths inch. Longer treatment or greater differentiation would bring on headache and dizziness, which would soon, however, pass away on cessation of treatment. For the first few days she had slight increase of cough and expectoration. As she became accustomed to the treatment the differentiation was increased. At first pine needle spray, Gardner's extract, was used, 8 minims to the ounce, and afterward creasote, gtt. 3 to the ounce, which seemed more soothing and relieved her cough better.

January 30th, 1888. Respiratory differentiation four-tenths inch variation for ten minutes. Inspiratory differentiation two-tenths inch for two minutes. Her head felt full, and treatment was suspended. Says she coughs and expectorates less since commencing treatment and has less dyspnœa.

March 30th. Seated in cabinet, pulse 74. Respiratory differentiation four-tenths inch variation for ten minutes. Directly on opening door of cabinet, pulse 78.

April 7th. Pulse 74. Respiratory differentiation four-tenths inch for thirteen minutes. Pulse, 80. Inspiratory differentiation three-tenths inch for four minutes. Pulse, 80. Felt dizzy. Circumference of chest has increased one inch by measurement since beginning treatment.

The face would often become appreciably flushed during the treatment, but not invariably so. The nasal catarrh improved at the time and has troubled her less for the last two years since treatment ceased than it did previously. I have watched the patient for several years, and believe that her general condition has been better since the treatment than before, although the improvement has not been very great. The physical signs show no marked change, although her lungs expand better than before.

In the foregoing and the following cases almost daily notes were kept, but it is unnecessary to produce the histories in full, and I shall give only a synopsis, with the daily notes picked out here and there as they seem to be specially important.

Case 2. C. C., aged 38, laborer. Emphysema and bronchitis. January 18th, 1888.

Family history good. Never been a drinker. Smokes ten or twelve pipes daily. Has had cough as long as he can remember. Never had hæmoptysis. Not much expectoration, often brown, sometimes yellow. Not much cough, hacking, not paroxysmal. No dyspnœa. Has not lost flesh in the past two or three years ; thinks he has gained. Appetite fair. Bowels always regular. Looks well nourished. Weight about 150 pounds. No night sweats.

Physical examination. Inspection. Depression above the clavicles and below to outer side of chest. Over sternum and to either side some bulging of chest. Apex of heart in normal position. Percussion. Increased pulmonary resonance over both lungs in front and behind. Auscultation. Pulmonary second sound slightly accentuated. Apex beat diffused. Expiration prolonged over both lungs in front and behind. Respiration harsh in right suprascapular region and feeble over rest of lungs. Vocal resonance and fremitus increased over right lung. No rales.

The patient had treatment in the cabinet six times when he obtained work which prevented his continuing. Expiratory differentiation was begun at two-tenths inch by manometer and increased to three-tenths and four-tenths inch for ten minutes, each time followed by respiratory differentiation four-tenths inch variation for from ten to fifteen minutes. Spray of bichloride of mercury $\frac{1}{1000}$ was used. While in the cabinet he had no cough, dyspnœa, nor dizziness. After treatment was over, however, he sometimes felt slight dizziness. His appetite improved and he felt in better spirits. Always felt decidedly better for a day or two after each treatment. He did not continue long enough for a fair trial.

Case 3. P. L., aged 44 years. Ireland, laborer. January 25th, 1888. Emphysema, bronchitis, pleuritic adhesions.

Does not know the cause of death of any of his family.

Previous history: had pneumonia on left side ten years ago. No specific history. Has been accustomed to get drunk occasionally for many years. Has had cough about four years. Catches cold frequently and then expectorates abundantly, but at other times not so much. Never spits blood. Has had night sweats. Has considerable dyspnœa at times; is never entirely free from it, but it is never paroxysmal. Does not think he has lost flesh; weighs now about 150 pounds, and has never weighed much more. Appetite good. Bowels regular.

Present condition: coughs now very little during the day, but a good deal at night, especially in the middle of the night, when he wakes up coughing. No night sweats now. Expectoration sometimes thin and white and at others thick, yellow, and in round balls. Dyspnœa on exertion or loud talking, but not when quiet. Is well developed. Face and body a good color, and he has a good deal of adipose.

Physical examination. Depression above the clavicles and below at outer third. Apex of heart felt in sixth interspace. Some bulging under clavicles at inner two-thirds. Percussion. Increased pulmonary resonance, low pitched, over both lungs. Under left clavicle slight dulness; same in left infrascapular region. Auscultation. Expiration prolonged over both lungs,

and respiration harsh except at bases in front. Most harsh under the clavicles, and under the right clavicle expiration is harsher than inspiration, with a few whistling rales. Vocal resonance and fremitus increased over right side except at base in front, most markedly in right suprascapular region.

This patient received treatment in the cabinet twenty times. Each time a spray of bichloride of mercury $\frac{1}{1000}$ was used. He had respiratory differentiation beginning gradually and reaching two-tenths inch variation per manometer for eight minutes at the first treatment and then expiratory differentiation one-tenth inch for two minutes, which made him slightly dizzy, and it was discontinued. After a few treatments, a variation in respiratory differentiation of four-tenths inch was reached and continued for fifteen minutes, and then expiratory differentiation was used at a pressure increasing after a few times to six-tenths inch for ten minutes, and this was continued throughout. During the time he took a cough mixture of morphine, hydrocyanic acid, and camphor water occasionally, but no other medicine. Three times during the early treatments dry retching was produced and several times he was slightly nauseated, and occasionally throughout dizziness was produced. But as soon as these symptoms appeared the cabinet was opened and they passed away almost at once.

February 3d. Respiratory differentiation two-tenths inch variation for ten minutes. Expiratory differentiation four-tenths inch ten minutes. Since beginning (this is the fourth treatment) dyspnœa has almost disappeared, and cough and expectoration are much less. To-day a variation of more than two-tenths inch nauseated him and brought on retching.

February 8th. Respiratory differentiation four-tenths inch ten minutes. As he became flushed and had a distressed appearance, the cabinet was opened. Expiratory differentiation five-tenths inch five minutes. Dyspnœa has left him. Says he feels better and coughs scarcely at all. Expectoration is less and thinner, and white instead of yellow.

February 10th. Respiratory differentiation four-tenths inch ten minutes. Was slightly nauseated at the end of six minutes, but it passed off in a few seconds and treatment was continued. Expiratory differentiation five-tenths inch five minutes. Says he expectorates less than half as much as at first.

February 15th. Respiratory differentiation four-tenths inch fifteen minutes. Slight dizziness. Expiratory differentiation five-tenths inch five minutes. Scarcely any dyspnœa, cough, or expectoration.

February 17th. Used to have paroxysms of coughing, coming on at night and lasting about fifteen minutes, but now has none.

March 5th. Respiratory differentiation four-tenths inch

fifteen minutes. His sputa was examined by Dr. W. L. Stowell, who reported a great quantity of pus and fatty degenerated epithelia. No bacilli of tuberculosis.

March 8th. Pulse 54, respiratory differentiation four-tenths inch. Seventeen minutes. Expiratory differentiation six-tenths inch ten minutes. After treatment pulse 60, and fuller.

Physical examination : same as the first examination, except that respiration is scarcely at all harsh. Expiration under clavicles only slightly harsh. No whistling rales under the right clavicle. Expiration prolonged. It does not seem as long as at the last examination, but on this point I am not positive.

March 19th. Pulse 64. Respiratory differentiation four-tenths inch ten minutes. Pulse 68. Expiratory differentiation six-tenths inch eight minutes. Pulse 60.

March 22d. Pulse 64. Respiratory differentiation four-tenths inch fifteen minutes. Pulse 72. Expiratory differentiation six-tenths inch ten minutes. Pulse 62.

March 30th. Pulse 72. Respiratory differentiation four-tenths inch fifteen minutes. Pulse 76. Expiratory differentiation six-tenths inch eight minutes.

April 4th. Pulse 72. Respiratory differentiation four-tenths inch fifteen minutes. Pulse 76. Expiratory differentiation six-tenths inch ten minutes. Pulse 80.

April 11th. Says that for the last three days he has been troubled with giddiness, and at times feels as if he would fall down. It was thought best to discontinue the cabinet treatment for the present.

July 15th, 1889. Since the last treatment the patient has been to see me several times. He thinks that he has been better since, does not suffer from dyspnœa, and is able to work. He occasionally takes terebene for his cough, but otherwise does not feel the need of medicine. I believe he has been benefited, but as emphysema is a disease that remains sometimes almost in *statu quo* for considerable periods, it is difficult to say if he is really better than he would have been without the use of the cabinet.

Case 4. M. W. B., aged 37 years. Sexton. Phthisis pulmonalis. February 20th, 1888. Family history good.

Previous history : had typhoid-fever seventeen years ago ; was well afterward. Has had cough for thirteen years. At first the cough was hacking, but for the past few years has been paroxysmal. Has had a good deal of frothy, light brown expectoration. Slight hæmoptysis four years ago ; sputa is occasionally tinged with blood. Had no dyspnœa until five years ago, could run or take any kind of exercise without discomfort ; since then has had dyspnœa when he moves about, but none when at rest. Had night sweats seven or eight

years ago; none since. Appetite has not been very good. Has not lost much flesh; averages about 113 pounds.

Present condition. Coughs considerably in paroxysms. Expectoration abundant. Lightish brown sometimes, and at others yellow. No night sweats. Dyspnœa on exertion. Appetite fair. Bowels costive. He is a small, spare man, with face somewhat emaciated.

Physical examination: chest rather flat and fairly well covered with adipose. On percussion pulmonary resonance over both lungs in front. Dulness in right suprascapular region. On auscultation respiration harsh and expiration prolonged under both clavicles. Coarse moist rales over both lungs in front; most abundant under right clavicle, and more abundant over right than over left side. Sonorous rales over lower third of left lung in expiration. Bronchial breathing in right suprascapular region, and a few coarse rales drier than in front. Over remainder of right lung respiration slightly harsh. In left suprascapular region harsh respiration, expiration harsher than inspiration, and coarse rales. A few rales over lower half of left lung.

Vocal resonance and fremitus increased over right infraclavicular region, over right lung behind, and in left suprascapular region.

This patient had twenty treatments, extending over three months. He had respiratory differentiation each time four-tenths inch variation for fifteen minutes, followed by inspiratory differentiation four-tenths inch for from ten to fifteen minutes. Spray of bichloride of mercury $\frac{1}{1000}$ was used. Two or three times he had a feeling of fulness in the head and slight dizziness, and once a little nausea in the cabinet, but was not otherwise inconvenienced.

March 24th. His appetite is better than formerly. Coughs less.

May 15th. Physical examination: similar to the first examination, except inspiration is not so harsh under the clavicles, and a few rales are heard at the right apex in front and at the left apex behind; a very few over the rest of the lungs. There is perceptible improvement in the physical signs. Before the use of the cabinet he could not lie on the left side more than a few minutes without a severe fit of coughing, but now he can do so for several hours without discomfort. He feels much better. Has less cough and dyspnœa. Appetite has improved. Believes he has gained weight.

The pulse was frequently taken before he got into the cabinet, after respiratory differentiation and after inspiratory differentiation. It will be seen from the table that in this case it was usually decreased by the former and increased by the latter.

Before Treatment, 76	After Resp. Dif., 84	After Inspir. Dif., 80
" " 102	" " " 90	" " " 96
" " 92	" " " 84	" " " 96
" " 88	" " " 82	" " " 96
" " 92	" " " 88	" " " 92
" " 88	" " " 88	" " " 98
" " 92	" " " 84	" " " 96
" " 84	" " " 84	" " " 92
" " 108	" " " 98	" " " 102
" " 92	" " " 98	" " " 100
" " 88	" " " 84	" " " 92
" " 82	" " " 82	" " " 84
" " 84	" " " 82	" " " 92

This case was decidedly improved by the cabinet treatment, and he says now, May, 1890, that he has been better since than he was for some time previous. A longer treatment would, I am satisfied, have been of further benefit.

Case 5. I was myself treated in the cabinet twenty-one times through a period of four months. I was somewhat debilitated, and had been troubled with dyspepsia. I also had some old adhesions at the bases of the lungs which had not prevented pretty free expansion, but which have at times, acting with other causes, doubtless had a depressing effect upon my general condition. I was not in a condition to make treatment of any kind necessary, but I wished to observe the effect of the cabinet upon myself. A careful record of the results were kept, which it is unnecessary to give in full, but which may be of sufficient interest to warrant some consideration. The usual treatment was to take respiratory differentiation four-tenths to five-tenths inch variation from fifteen to twenty minutes, the time being rather less during the earlier sittings and occasionally longer afterward. This was, as a rule, followed by inspiratory differentiation at first two-tenths inch rarefaction and in the later treatments reaching six-tenths inch for from five to ten minutes. A feeling of fulness in the head would at times, but not invariably, come on after being in the cabinet a short time. But this would soon pass off even without discontinuing treatment, and was apt to be followed by a clearness of the head and a slight feeling of exhilaration, much more marked sometimes than at others, and a feeling of drowsiness was apt to come on later. A feeling of fulness over the liver, sometimes amounting to actual pain, was not uncommon. From February 14th to March 14th my weight increased three and a half pounds. Unfortunately I had not weighed myself at first, but think it safe to say that the whole increase was equal to double that amount. I was benefited by the treatment. The dyspepsia left me, the appetite improved, and the expansion of the chest was increased.

Case 6. Mr. M., aged about fifty-two. The patient has old pleuritic adhesions which, although not extensive nor interfering seriously with the expansion of the lungs, have a tendency to keep his general condition below par. He had the same treatment the same number of times as Case 5, with substantially the same results as regards his sensations in the cabinet. He was benefited, the expansion of the lungs being increased one inch. He says his voice is stronger, he lectures with less fatigue, and does not feel the strain on his voice afterward, as he formerly did.

GRAPHIC METHODS OF RECORDING DISEASED CONDITIONS OF THE LUNGS, AND A NEW FORM OF PNEUMOGRAPH.

By J. H. Kellogg, M.D., of Battle Creek, Mich.

The introduction of the graphic method of studying physiological conditions introduced a new era in physiology. By the aid of this method of study in fact, one might almost say that a new science in physiology has been created. Some attempt has been made to introduce the methods of the physiological laboratory into practical medicine, but so little has been done in this direction, one might almost consider this a new field waiting for exploration. For several years I have been working in this direction, as I have had opportunity, and have found the study an exceedingly interesting and profitable one. I have made some thousands of observations with the sphygmograph, cardiograph, pneumograph, and other instruments which utilize the recording tambour and cylinder, but do not consider myself an expert with any of these instruments, as I continually find myself learning new facts respecting their use and indications. I wish, however, to present some of the results of my work with the pneumograph, and to show a new instrument for studying respiratory movements, and a small apparatus which I have devised for an approximate determination of the amount of CO_2 contained in atmospheric air or the air of exhalation. The pneumograph which I commonly employ is the form devised by Paul Bert, somewhat modified by Dr. Mays, of Philadelphia. I have employed this instrument especially in the study of respiration in healthy persons.

Up to the present time all standard authorities in physiology have been agreed that there are two distinct types of respiration in human beings characteristic of the two sexes—

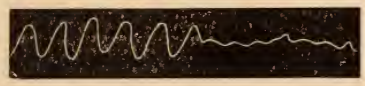
namely, abdominal and costal, it being declared that adult males breathe chiefly with the lower portion of the chest, using the diaphragm and abdominal muscles freely, while women breathe chiefly with the upper part of the chest. In arriving at this conclusion, physiologists seem to have confined their studies of respiration in women wholly to civilized women, in whom the mode of dress is evidently well calculated to produce serious inteference with the respiratory function. Eleven years ago, referring to this alleged natural difference between the respiration of man and woman, I wrote as follows :

" It is undoubtedly true that most women do breathe almost exclusively with the upper part of the chest ; but whether this is a natural peculiarity or an acquired, unnatural, and depraved one, is a question which I am decidedly inclined to answer in harmony with the latter supposition, basing my conclusion upon the following undeniable facts : First, in childhood, and until about the age of puberty, respiration in the boy and the girl is exactly the same. Second, although there is a change in the mode of respiration, in most females, usually soon after the period of puberty, marked by increased costal respiration, this change can be accounted for on other than physiological grounds. Third, I believe the cause of this modification of respiration is the change of dress which is usually made about the time of puberty. The young girl is now becoming a woman, and must acquire the art of lacing, wearing corsets, stays, and sundry other contrivances which will aid in producing a fine form. Fourth, I have met a number of ladies, whose good fortune and good sense had delivered them from the distorting influence of corset wearing and tight lacing, and have invariably observed that they are capable of as deep respiration as men, and practise it naturally. I am thoroughly convinced that this so-called physiological difference between man and woman is really a pathological rather than a physiological difference. In short, I believe that the only reason why women do not, under ordinary circumstances, breathe as men do, is simply that they cannot breathe naturally."

I have made extensive studies of this subject, having obtained tracings from hundreds of women, including not only civilized women, but twenty Chinese women, and twenty-five

Costal. **Abdominal.**

Fig. 1. Pneumographic Tracing,—Man.



Costal. **Abdominal.**

Fig. 2. Pneumographic Tracing,—Woman in Corset.

Costal. **Abdominal.**

Fig. 3. Pneumographic Tracing,—Man in Corset.

Costal. **Abdominal.**

Fig. 4. Pneumographic Tracing,—Chinese Woman.

Costal. **Abdominal.**

Fig. 5. Pneumographic Tracing,—Chickasaw Indian Woman.

Costal. **Abdominal.**

Fig. 6. Pneumographic Tracing,—Dog.

Costal. **Abdominal.**

Fig. 7. Pneumographic Tracing,—Dog, with corset on.

Costal. **Abdominal.**

Fig. 8. Pneumographic Tracing,—Reformed Corset Wearer.

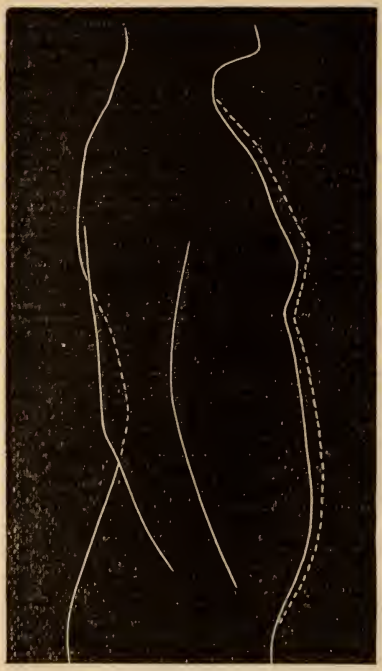


Fig. 10. Normal Respiration.

Fig. 11. Clavicular Respiration.

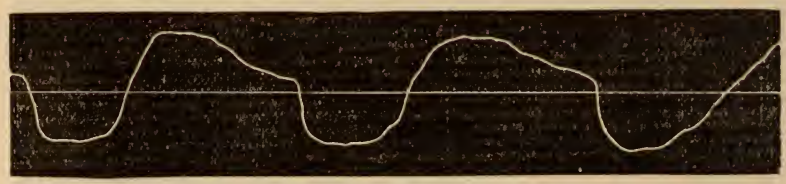


Fig. 13. Pneographic Tracing,—Healthy Woman.

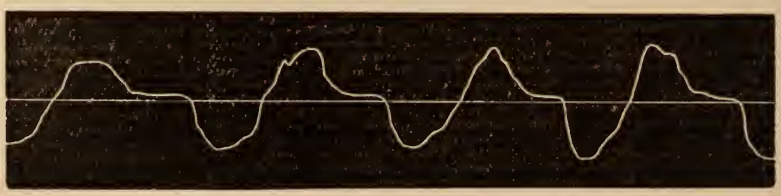


Fig. 14. Pneographic Tracing,—Woman in Corset.

Indian women of different tribes, most of whom were of the primitive Yuma Indian tribe—women who had never worn any other clothing than small bark aprons before and behind. Among the civilized women were women of fashion, reared in luxury, laboring women, French and Italian peasant women, and artists' models. I have also made tracings of male and female dogs. As the result I find that men and women breathe alike, as do the males and females of other species, when the clothing worn is not such as to interfere with the respiratory movements. The pneumographic tracings shown in Figs. 1 to 8 explain themselves, the degree of movement of the part examined being indicated by the amplitude of the curves.

By means of an instrument which I have recently devised, shown in Fig. 9, for which I have not yet found an appropriate name, I have taken a large number of outline tracings of the body under various conditions, for the purpose of studying the relation of the contour of the body to internal conditions, and have also made a study of the changes which occur in the form of the trunk in respiratory movements.

This apparatus consists (1) of a frame-work with a solid back and two upright bars placed about two feet in front of the back and parallel with it, and (2) of a pencil carrier which supports a brass tube at the end of which is fixed a pencil or crayon. In use, the pencil carrier is placed against the two vertical bars as shown in the cut. The pencil carrier holds the marking rod which it supports always at right angles with itself and with the back of the apparatus. In making a tracing, the patient stands in the frame-work with the back or side against the back, which bears a sheet of paper of sufficient size to receive the outline to be made. The patient is divested of all clothing except a single covering. The pencil carrier being placed in position, is manipulated in such a manner as to carry the marking rod close to the body, thus securing an absolutely perfect profile. By the aid of this apparatus, one can quickly discover and record deviations from the normal contour of the body, or any degree of asymmetry which may exist.

Figs. 10 and 11 show respectively correct and incorrect mode of breathing. In normal respiration the whole trunk

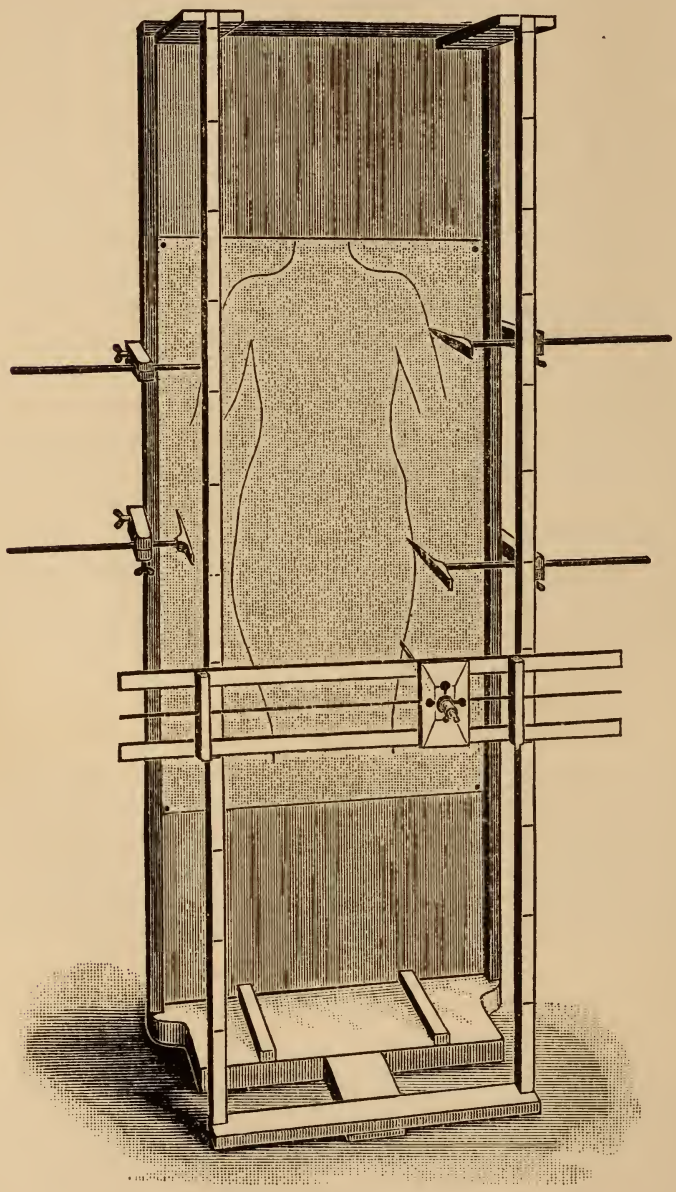


Fig. 9. Tracing Apparatus.

expands, but in the mode of respiration induced by corset wearing, and shown in Fig. 11, the upper part of the trunk is abnormally expanded while the lower part is retracted. The respiratory movement shown in Fig. 11 was somewhat exaggerated, but is a fair representation of the mode of breathing by women who wear clothing which constricts the waist, and prevents the normal respiratory movement at this part of the body.

Corset-wearing, perhaps, does less damage to the lungs than to the organs of the lower half of the trunk, the health of which is more dependent upon the maintenance of the normal mode of action in the respiratory movements than is that of the lungs. The mischief which results from displacement of liver, stomach, kidneys, bowels, and pelvic organs is sufficient to be the occasion of chronic invalidism in many thousands of women in every civilized land. But I will say no more upon this subject, as it is one the consideration of which is, perhaps, not appropriate for this occasion.

The instrument which I herewith present, Fig. 12, is a new form of pneumograph, or perhaps it might more properly be called a pneograph. The tracings obtained by other forms of the pneumograph, or stethograph, express only the amplitude of movement of those portions of the wall of the chest or abdomen to which they are applied. This instrument enables us to study the character of the whole respiratory movement. It consists essentially of two chambers, separated by a diaphragm of thin rubber. One of these chambers is connected with a recording tambour which writes upon a sheet of smoked paper carried by a revolving cylinder such as is used with the ordinary pneumograph. With the other chamber is connected a breathing mask, which, in use, is placed over the mouth and nose. This chamber is provided with a second opening, the size of which is controlled by a shutter, which can

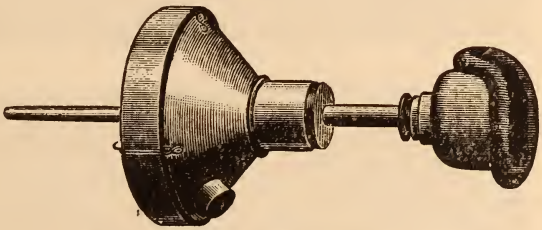


Fig. 12. Pneograph, or New Form of Pneumograph.

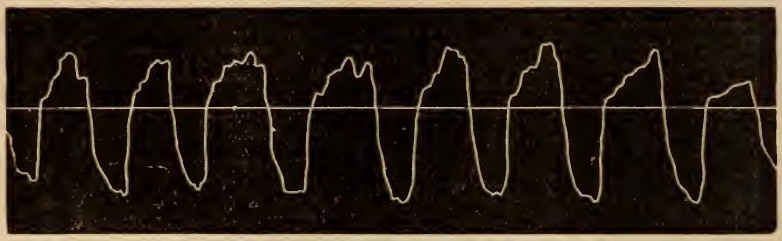


Fig. 15. Pneographic Tracing,—Woman with Phthisis, one lung consolidated.

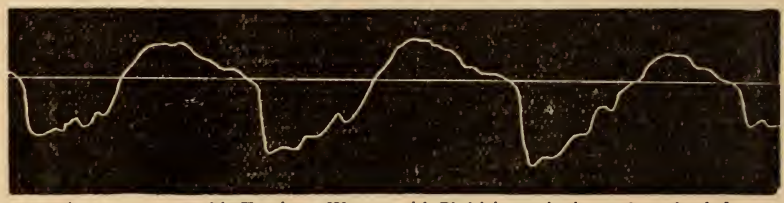


Fig. 16. Pneographic Tracing,—Woman with Phthisis, cavity in one lung, healed.

Fig. 17. Pneographic Tracing,— Woman with Asthma and Emphysema.

Fig. 18. Pneographic Tracing,— Man with Asthma and Emphysema.

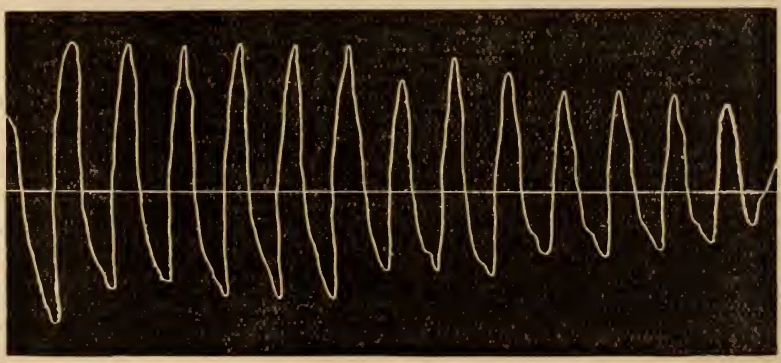


Fig. 19. Pneographic Tracing,—Man with Diabetic Coma.

be adjusted at will. In use, the patient under examination breathes into this chamber, which may be called the breathing chamber of the instrument. With the chamber completely closed, the breath would simply pass from the lungs into the chamber and back again, there being no change of air, but with the shutter open, air is drawn into the chamber with each inhalation and expelled at each exhalation. The resistance which the air meets in passing through the shuttered opening gives rise to changes in pressure within the breathing chamber, the pressure being diminished during inspiration and increased during expiration. The amount of this change in pressure will depend upon the size of the opening, and can be exactly measured by connecting the breathing tube with a water column. The average pressure which I have observed is equivalent to a column of water one-half inch in height. This is certainly an amount too small to seriously modify the form of the respiratory movements. It is sometimes advantageous to increase the resistance by nearly closing the shutter, as by this means certain peculiarities in the respiratory movement may be exaggerated and so rendered easier of study.

The changes in pressure in the breathing chamber of course give rise to movements of the rubber diaphragm separating the two chambers of the instrument. These movements actuate in turn the diaphragm of the recording tambour, which writes upon a revolving cylinder in the usual way. The accompanying tracings, shown in Figs. 13 to 19, are fair examples of the records made by this instrument.

In using the pneograph, after the recording instrument has been adjusted to the cylinder, the latter is allowed to make one revolution before the writing begins. The base line thus drawn furnishes a means of comparing the relative times occupied in the two movements of respiration, since in ordinary respiration the whole of the respiratory act is recorded below the line and the whole of the expiratory act above the line. When the respiratory movements are very rapid, there is not the same uniformity in this respect as when the movements are slow ; nevertheless, the base line is necessary to enable one to make a careful comparative study of these tracings.

Fig. 13. This is a pneograph tracing obtained from a healthy woman breathing naturally.

Fig. 14. This tracing was taken from the same subject as the preceding. It shows very clearly the influence of the corset in increasing the rapidity of the respiratory act and materially changing its form. The sudden fall of the curve of expiration was doubtless the result of the pressure of the corset, producing an undue acceleration of the expiratory act.

Fig. 15. This tracing was taken from a patient suffering from active tuberculosis of the left lung. Almost the entire lung was consolidated. The sudden but poorly sustained character of the expiratory movement is just such a curve as one would expect to find in a case of this sort.

Fig. 16. This is a tracing obtained from a lady patient who had suffered from phthisis some years before, and, at the time the tracing was taken, had in one lung a cavity larger than a hen's egg, nearly the entire lung being disabled by fibroid thickening and cicatricial contraction.

Figs. 17 and 18. These two tracings were obtained from patients suffering from chronic bronchial catarrh, asthma, and emphysema. The extreme lengthening of the expiratory movement is very marked in both cases. In Fig. 18 the dip of the expiratory portion of the curve is evidence that the expiratory movement is not only weak, as shown by the small amplitude of the curve above the base line, but is poorly sustained.

Fig. 19. This extraordinary tracing was taken from a patient suffering from diabetic coma, a few hours before death. The explosive character of the breath is clearly indicated by the vertical up-strokes. The gradual decrease in the amplitude of the breathing movements is also clearly shown. At the time this tracing was taken, the patient's respiration was 60 per minute, and the pulse was 165.

I devised this instrument some years ago, and have obtained with it a large number of tracings from patients suffering from a variety of morbid conditions, as well as persons in health, and have noted many interesting peculiarities, many of which I am not prepared to interpret ; but I am confident that studies of this sort will prove a fruitful source of information respecting morbid conditions which are sometimes quite obscure.

It is evident that this instrument affords a very excellent means of detecting small degrees of emphysema, as well as

various forms of weakness in the muscular part of the respiratory apparatus.

The need of some simple and reasonably accurate apparatus for the determination of the quantity of CO_2 found in atmospheric air has been recognized for many years. I have experimented with different forms of apparatus for making a quantitative estimation of CO_2, and finally perfected the simple apparatus shown in Fig. 20. This apparatus consists essentially of two graduated glass bottles holding one liter each, connected by tubing in such a way that one liter of water can be made to syphon from one bottle to the other, and a glass tube about 16 inches in height, in the bottom of which is fixed a tube with a small aperture which is connected with the two bottles in such a manner that as the water syphons from one bottle to the other, the air contained in the empty bottle, as the bottle fills, will be forced through the small opening and made to pass upward through the vertical tube which is supported against the standard, which also serves to support the bottle from which syphonage is taking place. In using the apparatus, the vertical tube is partly filled with lime or baryta water which absorbs the CO_2 contained in the air which is made to bubble up through it from the aperture at the bottom. The lime or baryta water is colored by a solution of phenol-phthalien. The purple color produced by the phenol-phthalien disappears instantly as

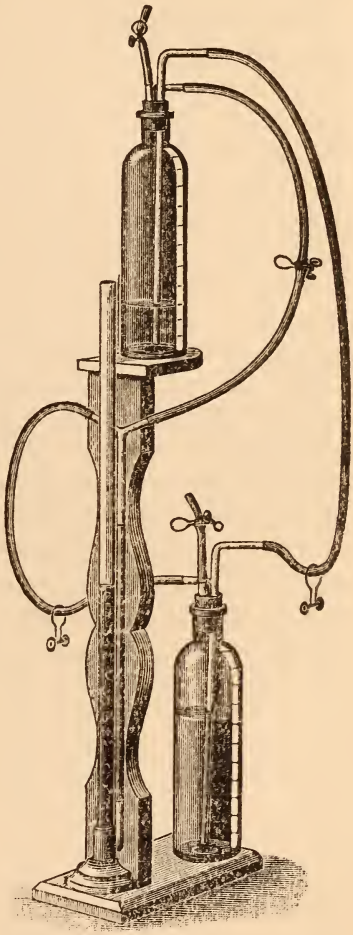


Fig. 20. Apparatus for determining CO_2.

soon as the lime or baryta contained in the solution is wholly neutralized by the CO_2, and is thus a most delicate means of determining when a sufficient quantity of air has been passed through the apparatus. It will be evident to any one at all familiar with chemical estimations, that it is only necessary to know the amount of lime or baryta contained in the solution and the amount of air passed through the solution, to determine the proportion of CO_2 contained in the air examined. I find in practice that 2cc. of a saturated solution of lime water are exactly neutralized by 1cc. of CO_2. It is of course necessary to avoid passing the air through the apparatus too rapidly, as time must be allowed for the absorption of the gas as it passes through the solution.

With this apparatus, an approximately correct estimation can be made of the amount of CO_2 present in the atmosphere, or in the expired breath of the patient, at any time, with very little expense of either time or effort.

The accuracy of the apparatus may be much increased by employing a solution of caustic potash, to absorb the CO_2, instead of lime-water, and making the air pass through a second very weak solution of lime-water containing the indicator.

The information derived from this instrument may be of great value in certain cases of phthisis in which a considerable amount of lung tissue is involved, also in cases of emphysema, hydrothorax, empyemia, and in cases of unresolved pneumonia.

DISCUSSION.

Dr. V. Y. Bowditch, of Boston, Mass.: "I feel that I would like to say a few words on Dr. Cammann's paper on the Pneumatic Treatment of Disease. I imagine from the results of his cases that he considers it, as I do, a valuable adjunct in the treatment of pulmonary diseases. Certain it is in my use of it, since Dr. Williams introduced it to the profession, I have come to the conclusion that it is often a valuable adjunct in the treatment of pulmonary diseases, but it is not a panacea for all diseases. I think the greater part of its beneficial influence comes from the gymnastic effect it has upon the chest.

"I notice Dr. Cammann has used bichloride of mercury; I am extremely sceptical as to the benefit of that. Doubtless certain vapors have a beneficial influence in certain cases of bronchitis. I have seen several cases of that kind where the results have been very striking. I can recall two or three cases where there has been an arrest of serious disease in the last few years."

Dr. J. H. Kellogg: "I wish merely to call attention to a simple form of apparatus by which pneumatic treatment can be administered. It consists of a cylinder which is connected with an injection apparatus such as is used for supplying water to boilers. A stream of water passes through the pipe by injection and draws the air in. The water pipe is connected with the cylinder. It will lower it one tenth of an atmosphere. One thirtieth of an atmosphere is about as much as one can use. By reversing the apparatus you get pressure. You can get any amount of pressure you wish to up to the extent of water pressure. It is very simple, and it is continuous in its action. You breathe into the cylinder and the injection apparatus draws the air out. This small tube passes down into this larger tube; here is two inches of mercury. Just as soon as the mercury rises two inches the air bubbles up in and keeps the pressure down to that point, so it is automatic in action. I have the cylinder down in the basement, and a switchboard connected with it in the office. There is a small

hole in the bottom, so the water will run out in the intervals between using."

Dr. E. Fletcher Ingals, of Chicago, Ill.: "It occurs to me that possibly the whole benefit comes from the patient's efforts at inspiration and expiration, and that the same thing might be accomplished if no instrument was used. I do not state that as my positive conclusion, but think it probable. I doubt very much whether there is the slightest increased pressure in these inhalation, even in the trachea. I have used inhalation more or less, but not with a view to the germicidal effects. I can recall several cases in which I am satisfied inhalation has given the patient great benefit."

Dr. S. E. Solly, of Colorado Springs, Col.: "As Dr. Ingals has spoken of inhalation, I can corroborate what he says from my own experience. I use inhalation to some extent. I do not ascribe the germicidal properties to its use, but it is the exercise of breathing and also the benefit you get from the drugs on the mucous membrane. There was somebody in Boston not of the regular profession who used to cure patients, and they had different methods of breathing which does them good. Where there is a good deal of secretion from the tubes no doubt they are very much relieved by it. I think the point about the compressed air and rarefied air is a good one. I think the benefit is very largely induced by deeper breathing, deeper inhalation of the breath, but it is doubtful whether there is very much direct effect from the compressed air. But I have seen great benefit from systematic inhalation. I have also seen benefit with medicated inhalations."

Dr. V. Y. Bowditch: "In regard to the use of the cabinet, I do not mean to lay stress on that. I think a great deal can be accomplished by making the patient take deep, full respirations and forcing out the breath; I think that is very much neglected. But personally I have tried the cabinet, and the feeling to me is much more satisfactory; that is, in the cabinet I feel that I am getting fuller pressure. I go back to the original question that we can accomplish a great deal more than by ordinary inspiration."

Dr. J. H. Kellogg: "I am sure we can get more air into the lungs with compressed air, and have taken pains to measure the amount of air a person can exhale, having measured the

compressed air ; and I find it can be increased twenty-five or thirty per cent. The amount of air which a patient could exhale into rarefied air I found could be increased more than double—the patient would exhale twice as much with rarefied air as when left to his own effort. I am certain very much can be done with this apparatus ; but the great weakness is that it occupies so short a time compared with the whole twenty-four hours. I have many patients on whom I have seen no effect at all. This apparatus here exhibited the patient can use himself. The patient lets the air into the lungs from the bag. I find a patient can use this an hour or so at a time. He can pass the air through a bottle containing the various balsams, pass the air through that, and pass it into the lungs in that way. I find patients derive a good deal of advantage from the use of the bag. The patient takes about one quarter of his respiration from the bag. I have also experimented with medicated atmospheres. I have thought the patients did not get as much benefit from inhalations as they would if exposed a longer time. I have rooms in which the air is medicated as it comes into the room. I find that the patients derive more benefit from this method than from the use of inhalations alone. I hope we shall devise some means to use medicated atmospheres. I have devised an apparatus by which the atmosphere is medicated. I use the various gums, and have seen great benefit in the various cases."

Dr. Francis H. Atkins, of Las Vegas, N. M.: "I have used medicated inhalations with very decided success. To make it simple and easy I have avoided all kinds of expensive apparatus. I have for a number of years used only a tin cup. I put hot water into it and a few drops of the inhaling fluid ; the patient takes that in his hands and, taking a deep inspiration, endeavors to fill his lungs as full as possible. I have seen enough benefit from it to be glad to continue the process. I have found it advantageous to use simple methods."

THE CLIMATE OF THE GREAT SALT LAKE BASIN.

By Dr. A. C. Standart, Salt Lake City, Utah.

When, in the year 1843, John C. Frémont stood upon an eminence overlooking the Great Salt Lake, he likened himself unto Balboa discovering the Pacific. Undoubtedly the great pathfinder of the continent felt a certain pride in his achievement, and would willingly be classed with Cook, Balboa, and other noted circumnavigators of the globe, yet history tells us Frémont had been preceded in his wanderings by "trappers in skin-boats," who, when he was in "short pants," had looked down upon the great inland sea across glistening sands, and had sailed upon its placid waters. However, we will accord to Frémont the honor of being the first distinguished traveller of note to tell us of the Great Salt Lake, of the wonderful climate of the Great Salt Lake Basin, and of its health-giving properties, and were he living to-day he could well take unto himself the credit of having discovered one of the greatest natural sanitaria of the world. That we feel that the ground is well taken will be our endeavor to show, to establish, and in turn to convince by such an array of facts and figures and statistical data that will preclude all possibility of any doubt in the premises. Climate, as we now understand it, is evolved in certain conditions of heat, moisture, atmosphere, soil, wind, and topography of the earth's surface. It is made variable according to the position of the sun relative to the earth, inclination of its rays to the earth's surface, and it is affected in its quality, whether at sea-level or at varying altitude. We may study climate generally and locally. If generally, we may include in our scope the whole inter-mountain region, and by this we mean portions of Colorado, New Mexico and Utah, to be covered by statistical information; if locally, as we propose to do in detail, we will confine ourselves to the Great Salt Lake Basin, possessing, as we believe, a climate distinctively *local* and peculiarly its own. The Great Salt Lake Basin lies in latitude 40° to 42° north, longitude 36°

west. It has an average elevation of 4300 feet above sea-level; it is encompassed on the east by a range of mountains trending north and south, on the west and south by an expanse of desert, and north and west the Basin proper is occupied in part by the Great Salt Lake itself covering an area of 2500 square miles. The prevailing winds are from the northwest. That there exists here an anomaly is made evident when we cite that, to reach tide-water, we have to go east 2000 and west 1000 miles, yet here in the mountains of Utah, 4300 feet above the sea, we have an immense body of water whose properties are intensely saline and whose density is seven times that of the water of the ocean. That the existence of this great inland sea in our midst is an influential factor bearing upon our local climatic conditions must be evident to all thinking minds; that it gives tonicity to our atmosphere a "maritime" quality—if we may so term it—is evident to anybody who breathes the air in all its softness and purity, as it is wafted across the bosom of the Great Salt Lake, finally to become dissipated in its individuality in its conflict with the cool mountain breezes as they come down to us through the cañons. Could there be anything more beautiful in nature than this interchange of meteorological conditions contributing as it does a "modicum" of comfort to all those under the spell of its influence. Certainly we see in the close proximity of this great body of water a mollifying effect, a moderator, a "governor" of meteorological conditions that necessarily attend mountain climates in general, viz., excessive march of the winds and inordinate variability of temperatures which, under other conditions would be objectionable for their suddenness and uncertainty. Compared with more favored climes, "favored" used more in the popular sense than through any inherent merit, we find that statistics will bear out our statement that the extreme yearly range of temperature in the Great Salt Lake Basin is less than that of any other inter-mountain region of note either in the United States or Continental Europe. For a period of twenty-four years these records show that the extreme yearly range of temperature has been less than 90° oftener than 100° and more; that at New York City the annual range is 114°, Montreal 140°, Chicago, 132°, St. Louis, 133°, Denver, 126°, while at

MAX. AND MIN. AND RANGE OF TEMPERATURE.

1880 to 1888.		Jan.	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	Mean	Spring	Summer	Fall	Winter
Salt Lake City.	Max.	35·7	40·1	50·6	58·6	69·3	80·3	88·	87·6	75·4	61·2	46·2	40·6	61·	59·5	85·3	60·9	38·8
	Min.	20·7	24·3	32·2	39·4	47·3	56·1	63·3	63·	52·4	36·3	28·3	26·9	41·2	39·6	60·8	39·0	24·0
	Range.	15·0	15·8	18·4	19·2	22·0	24·2	27·7	24·6	23·0	24·9	17·9	13·7	19·8	19·9	24·5	21·9	14·8
Denver.	Max.	39·9	43·8	52·3	59·2	69·8	80·3	85·4	82·7	75·9	63·6	50·	44·2	62·4	60·4	82·8	63·2	42·6
	Min.	16·6	19·1	27·2	35·3	43·9	53·6	59·2	57·9	48·9	37·3	25·1	21·5	37·2	35·5	56·9	37·1	19·1
	Range.	23·3	24·7	25·1	23·9	25·9	26·7	26·2	24·8	27·0	26·3	24·9	22·7	25·2	24·9	25·9	26·1	23·5
Los Angeles.	Max.	63·9	65·2	67·5	70·	76·3	80·	84·4	85·6	82·2	75·4	70·6	66·	73·9	71·3	83·7	76·1	65·
	Min.	42·	44·2	46·3	49·3	52·3	55·6	58·4	59·1	56·	50·8	46·4	45·3	50·6	49·3	57·7	51·1	43·8
	Range.	21·9	21·0	20·2	20·7	24·0	24·4	26·0	26·5	26·2	24·6	24·2	20·7	23·3	22·0	26·0	25·0	21·2
Jacksonville.	Max.	64·1	68·	71·1	77·7	83·2	88·4	91·	89·3	85·4	79·0	70·7	65·1	77·8	77·3	89·6	78·4	65·7
	Min.	47·9	52·3	54·5	60·9	67·	73·2	75·5	74·4	71·6	65·1	53·7	48·6	62·	60·8	74·4	63·5	49·6
	Range.	16·2	15·7	16·6	16·8	16·2	15·2	15·5	14·9	13·8	13·9	17·0	16·5	15·8	16·5	15·2	14·9	16·1
Des Moines.	Max.	25·9	32·7	43·7	60·6	73·5	81·3	87·6	83·8	74·8	62·2	45·7	31·9	58·6	59·3	84·2	60·9	30·2
	Min.	7·3	13·8	25·9	40·4	52·2	60·9	65·2	63·2	55·2	43·6	27·8	16·3	39·3	39·5	63·1	42·2	12·5
	Range.	18·6	18·9	17·8	20·2	21·3	20·4	22·4	20·6	19·6	18·6	17·9	15·6	19·3	19·8	21·1	18·7	13·7
Louisville.	Max.	41·7	48·6	54·4	64·4	77·3	85·5	88·1	86·4	80·0	69·0	54·6	45·0	66·2	65·7	86·0	67·9	45·1
	Min.	26·4	31·1	36·6	47·8	57·8	65·2	68·9	67·5	61·7	51·1	38·0	30·0	48·5	47·4	67·2	50·3	29·2
	Range.	15·3	16·5	16·8	18·6	19·5	18·3	19·2	18·9	18·3	17·9	16·6	15·0	17·7	18·3	18·8	17·6	15·9
New York City.	Max.	36·8	39·2	43·5	56·8	68·5	77·2	82·1	79·8	74·8	64·3	51·8	40·9	59·6	56·3	79·7	63·6	39·0
	Min.	23·2	24·8	29·0	40·1	51·7	60·3	66·2	64·5	59·5	48·8	37·4	27·9	44·5	40·3	63·7	48·6	25·3
	Range.	13·6	14·4	14·5	16·7	16·8	16·9	15·9	11·3	15·3	16·5	14·2	13·0	15·1	16·0	16·0	15·0	13·7

Salt Lake City, it has exceeded 100° but three times in twenty-four years and descended below zero but thirteen times in the same number of years. The average high extreme for these years was about 97½°, the average low extreme 4° above zero, making the average annual range 93½°. Compare our climate with that of the Pacific coast—and to be exact, we will elect Los Angeles as an initial point, we will endeavor to show wherein the denizens of Zion are more blessed than the residents of the "City of the Angels." The Salt Lake Basin is practically exempt from mist and fog the year round, while in Los Angeles, and, indeed, along the Pacific coast, it is the rule and not the exception for the fogs to roll in from the sea, and to assert their supremacy well-nigh to the noon hour before giving way to the sun's rays. With the high degree of humidity amounting practically to saturation of the atmosphere, there is the invariable accompaniment of depression and languor which attends equable climates. There is wanting a *tonicity* in the air, a quality only to be found where we have the four seasons. A locality to commend itself as a natural sanitarium should possess an exhilarating atmosphere. It should possess conditions of soil free from malaria; it should possess dryness and rarefaction of the air only found upon the attainment of altitude above sea-level, which experience has taught us affords the best results in the climatic treatment of disease. We append herein valuable data compiled by Professor Marcus E. Jones which represent his researches and observations covering a period of ten years and, as will be observed, brought down to the year 1888 inclusive, from which can be learned at a glance the annual temperature in degrees per month, the range of temperature, the relative humidity, the rainfall in inches per month, and the wind movement per month of the various localities named, viz , Los Angeles, Denver, Des Moines, New York City, Jacksonville, Fla., Louisville, Ky., and Salt Lake City.

All these meteorological conditions are to be noted in the consideration of the claims of any one locality as a sanitary resort. Many, I will not say all, diseases, seem to be moderated where meteorological conditions herein noted approach the "mean of means." Referring particularly to phthisis—a disease to which is chargeable the "mowing down" of one-eighth

RELATIVE HUMIDITY.

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Mean	Spring	Summer	Fall	Winter
Salt Lake City .. Apr. 1874-1888.	61	60	52	50	45	39	37	37	37	45	47	62	48	49	37	43	61
Denver..... 1872-1888.	55	54	50	52	50	45	47	49	46	47	52	49	50	51	47	48	53
Los Angeles.... July, 1877-1888.	65	69	73	73	72	71	71	71	72	68	64	66	70	73	71	68	67
Jacksonville..... 1872-1888.	76	72	68	69	69	73	73	76	77	76	75	75	74	69	74	76	74
Des Moines ..... Aug., 1878-1888.	73	72	70	64	66	72	70	69	71	71	70	75	70	67	70	71	73
Louisville..... 1872-1888.	73	69	63	59	63	67	67	67	68	67	67	71	67	62	67	67	71
New York City.. 1872-1888.	74	73	68	65	66	68	71	72	72	70	69	73	70	66	70	70	73

RAINFALL.

	Jan	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total	Spring	Summer	Fall	Winter
Salt Lake City . 1872-1888.	1·49	1·39	1·74	2·54	2·08	·81	·53	·82	·86	1·56	1·40	1·51	16·73	6·36	2·16	3·82	4·39
Denver..... 1872-1888.	·64	·48	·92	2·11	2·79	1·51	1·73	1·61	·93	·73	·74	·71	14·89	5·82	4·85	2·40	1·83
Los Angeles.... 1877-1888.	2·45	4·07	2·69	2·17	·43	·17	·03	·02	·03	·48	1·38	3·27	17·15	5·29	·22	1·89	9·79
Jacksonville.... 1872-1888.	3·65	3·20	3·50	3·34	4·30	5·94	6·20	6·88	7·89	5·70	2·65	3·31	56·61	10·16	11·14	19·02	16·24
Des Moines..... 1878-1888.	1·26	1·44	1·39	2·92	5·00	6·54	3·64	3·48	4·04	4·12	2·12	1·59	37·68	9·31	13·66	10·28	4·29
Louisville.... ... 1872-1888.	4·25	4·72	3·95	4·69	3·83	4·29	4·00	3·52	2·89	3·13	3·81	4·22	47·28	12·47	11·81	9·53	13·19
New York City.. 1872-1888.	3·79	3·80	3·85	3·30	2·94	3·54	4·50	4·76	3·27	3·30	3·44	3·28	43·77	10·09	12·80	10.07	10·87

of the human family—we find it meets with little if any encouragement upon elevated plateaus; practically, it is unknown in high altitudes except where transported. Speaking of fevers, we believe they are modified in their intensity in a climate that approaches the *asceptic* in air, soil, drainage, etc.; that they yield more readily to treatment. Of malarial-fever we may say it is not sporadic in our locality, and if present, it has been acquired elsewhere. The Salt Lake Basin being neither too high nor too low, is pre-eminently a natural sanitarium in the broadest sense of the term. The range of its attractions is unique. There are localized within its borders all the advantages to accrue from mountain resorts in general supplemented by salt water bathing, tonic properties of sea air, the ready access to thermal springs of varying degrees of temperature, and possessing qualities superior to those of Arkansas, without the disadvantages of the latter in climate. Upon reaching Zion distances are short to the various resorts and mountain retreats; a few hours' travel in any direction will annihilate them and place the invalid or tourist where he can enjoy his salt water bath, his "dip" at the springs, or with rod and gun, he can seek diversion along rushing streams in quest of the festive trout, or tramping over rugged hills and through mountain fastnesses, he can "trail" for larger game. The question may be asked, Will the climate permit such universal freedom to the invalid in his pursuit of health and recreation without undue risk? We may say, Yes, if in a season when we know the monthly fluctuation of the thermometer does not exceed 50°, the mean monthly temperature is at or within the limits of 50°, and the humidity is under 50°. The Great Salt Lake Basin enjoys immunity from high winds and severe electric storms. People do not have to seek shelter in their cellars, or flee to underground retreats to escape the fury of the typical Western cyclone. The wind movement in miles per month is less than that of any other locality, excepting Los Angeles, which latter, however, is offset by other disadvantages heretofore noted. The total movement of the wind over Salt Lake City does not exceed 50,000 miles in a year, while it is more than 100,000 miles on the Atlantic coast at Philadelphia, and in excess of 150,000 miles upon the open ocean.

MEAN TEMPERATURE.

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Mean	Spring	Summer	Fall	Winter
Salt Lake City... 1873-1888.	29·	33·8	42·	49·	57·5	67·6	75·4	74·6	64·3	51·8	38·6	32·9	51·3	49·5	72·5	51·6	31·9
Denver..... 1875-1888.	27·2	33·	38·8	46·1	56·7	66·4	72·1	69·9	61·6	50·4	37·5	31·9	49·4	47·5	69·5	49·8	30·7
Los Angeles..... 1877-1888.	52·1	54·4	56·5	58·3	62·2	65·5	68·7	69·9	67·6	62·8	58·2	53·	60·9	59·	68·	62·9	53·8
Jacksonville..... 1875-1888.	55·4	58·5	62·5	69·3	75·	80·4	82·8	81·	77·8	70·4	61·6	56·	69·2	69·9	81·4	69·9	56·6
Des Moines..... 1878-1888.	23·5	27·9	36·3	48·5	60·5	69·1	74·6	72·2	65·4	54·4	41·5	30·6	50·3	48.4	72·	53·8	27·3
Louisville..... 1875-1888.	34·2	38·7	44·8	56·4	67·	73·9	78·9	75·9	68·9	58·8	46·2	37·9	56·9	56·1	76·2	58·	36·9
New York City.. 1875-1888	29·5	31·3	36·2	47·4	59·1	68·	73·7	71·8	65·7	55·5	43·5	33·8	51·2	47·6	71·2	54·9	31·5

WIND MOVEMENT IN MILES PER MONTH.

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	T'l M'n	Spring	Summer	Fall	Winter
Salt Lake City. 1874-1887.	3028	3085	4164	4482	4654	4388	4236	4140	3888	3615	2869	2876	45428 3786	4400	4255	3457	2996
Denver..... 1871-1887.	5136	4556	5519	5404	5130	4774	4669	4317	4144	4549	4622	4688	57519 4793	5351	4587	4438	4793
Los Angeles. .. 1871-1887.	4378	4170	4065	4358	4044	3798	3634	3460	3330	3587	3719	3997	46 93 3849	4156	3631	3545	4182
Jacksonville.. .. 1871-1887.	4486	4536	5548	5416	4991	4883	4860	4606	4561	5145	4513	4485	58036 4836	5318	4783	7740	4502
Des Moines.. ... 1871-1887.	4825	4838	5677	5610	4601	3929	3597	3434	3980	4356	4734	4699	54331 4528	5296	3653	4357	4787
Louisville .. .... 1871-1887.	5980	5798	6606	5934	5094	4834	4211	4106	4299	4827	5385	5760	62848 5236	5876	4384	4837	5846
New York City.. 1870-1887.	7542	7674	8765	7114	6438	5754	5551	5509	5982	6837	7302	7731	82306 6859	7439	5605	6707	7649

I fear I am encroaching upon the limit of time assigned, but I cannot conclude my paper without asking your indulgence, while I advance another argument in favor of the climate of the Great Salt Lake Basin, and that is its *influence* upon the longevity of the human race. There is in Utah a beautiful custom in that one day of each year is set apart for the patriarchs among the people. That day is called "Old Folks' Day." It matters not whether Mormon, Moslem, Jew, or Gentile, they are the people! Upon that day all "old folks" of the community at large, who have attained the age of over seventy years, are invited by the municipality to commemorate the day in festivities inaugurated in their honor, and in which all can join and to which all are made welcome. To be brief and to the point which we wish to make—in one of these gatherings, which at the time represented 3 per cent of the *adult* population of the Great Salt Lake Basin, there were 1000 people who had attained the age of seventy years and over. Those over eighty and under ninety were distinguished by wearing blue rosettes, over ninety—of whom there were few to claim the honor—the white ribbon; while those who had passed the hundredth milestone along the pathway of life—and of whom there were but two—were entitled to be called centenarians, and to them was reserved the special honor to wear upon their breasts a golden star! These figures must surely impress one with a certain significance; while they become annihilated with the march of time, nevertheless they demonstrate to us a certain inherent right to be—a right vested in our incomparable climate. If they make such a showing among the people who had attained *adult* life long before they ever saw Utah, what can we expect from future generations to the manor born? What can we anticipate from the child growing up under such benign influences—other things being equal—other than a long life replete with healthfulness and happiness all contributive of the greatest good to the greatest number?

Dr. Denison.—I would like to say, with reference to the comparison of the climate on the two sides of the mountains—and that seems to be the subject that was drawn out by Dr. Standart's paper—that the records of mortality seem very often to be favorable for the other side, yet so far as the experience

of my patients is concerned, I have come to the conclusion that there was some advantage for the eastern slope, for the very reason that Professor Jones shows by his charts, that is, the relative humidity is much lower on this side of the mountain in cold weather. I take exception to the reason given why we have a dry condition here. It is not because our winds which blow across the plains are dry. That is often the case. But it is because the winds which blow from the west over the mountains, that have been deprived of their moisture, are the dry winds. The winds that are moist in Salt Lake City have been sapped of their moisture coming over the mountains, and they are the dryest winds we have. The southwest winds are our dry winds. In cold weather we have less relative humidity than they do on the other side of the mountains, and there is where there is an advantage. There is a slightly increased amount of moisture on the other side of the mountain, in my judgment, so far as the comparison of the two climates is concerned.

THE PREFERABLE ATTRIBUTES OF CLIMATE FOR CONSUMPTION, AS APPLIED TO THE WINTERS IN SOUTHERN NEW MEXICO, SOUTHERN ARIZONA, AND WESTERN TEXAS.

By W. M. YANDELL, M.D., Health Physician of El Paso, Tex.

THE following argument is based upon the paper read by Dr. Charles Denison, President of this Association, before the Ninth International Medical Congress, and entitled, "The Preferable Climate for Phthisis, or the Comparative Importance of Different Climatic Attributes in the arrest of Chronic Pulmonary Diseases."

Such exaggerated claims have been made by interested persons in reports upon the climate of different parts of the country, that statements unsupported by indisputable evidence have come to be looked upon with distrust, and I have in consequence, used only the official records of the Signal Service Department, of the Surgeon-General's Office and other disinterested and recognized reliable authorities.

Dr. Denison lays down the following propositions: "The order in which the first five subjects are arranged intended to indicate the relative importance of the attributes considered, the last five being added as confirmative of these main propositions."

PROPOSITIONS.

(1) *Dryness* as opposed to *moisture.*
(2) *Coolness* or cold preferable *to warmth or heat.*
(3) *Rarefaction* as opposed to *sea-level pressure.*
(4) *Sunshine* as opposed to *cloudiness.*
(5) *Variability* of temperature as opposed to *equability.*

CONFIRMATORY PROPOSITIONS.

6. *Marked diathermancy* of the air to be preferred to the *smoky atmosphere* of cities or the dense air strata of moist currents.

7. *Radiation and absorption* of *heat* by rocks and sandy loams better than *latent absorption* by water and damp clay soils.

8. *Mountainous configuration* of country (quick drainage) contrasted with flatness, etc., of level sections.

9. Frequent electrical changes of atmosphere, also *moderate winds* (except in quite cold weather) preferable to *continuous stillness of the air.*

10. *Inland altitudes* contrasted with sea-air (total absence of land influence) but in certain cases sea voyages and island resorts to be preferred as compromise substitutes for high altitudes.

The first proposition is not disputed, I believe, by any competent observer, and I shall only call attention to the following extracts from the "Statistical Report on the Sickness and Mortality in the United States Army, compiled from records of the Surgeon-General's Office, embracing a period of sixteen years, from January, 1839 to January, 1855, prepared under the direction of Surgeon-General Lawson, by Richard H. Coolidge, M.D., Assistant-Surgeon U. S. A.!"

Dr. Coolidge says: "The most important atmospherical condition for a consumptive is *dryness* . . . this fact has been forcibly impressed upon the compiler during the minute examinations necessary to the preparation of this report."

Denison's Climatic Charts, the result of compiling "some eight million separate Signal Service observations," show the whole of the region of which I speak to be in "extreme dryness," and every part of it in extremest dryness, except Fort Davis, which is just outside.

General A. W. Greely, Chief Signal Officer, in an article entitled, "Where shall we spend our Winter?" in Scribner, November, 1888, says: "The map of absolute humidity for January shows, with other data herewith, that . . . *dry, warm air* is found in Southwestern Texas and the southern portions of New Mexico and Arizona." No "Absolute Humidity" tables are given in the Signal Service reports, but this statement of the Chief Signal Officer is all sufficient.

For the purpose of comparison I have compiled the mean relative humidity from October 1st to April 30th inclusive, of the Signal Stations now or lately in existence in the territory

referred to ; of Denver and Santa Fé, as well-known Rocky Mountain health resorts ; of some of the principal cities of the country, and of San Diego, representing Southern California, and Jacksonville, representing Florida.

Fort Stanton, New Mexico, has lately been added to and Silver City and La Mesilla, New Mexico, were dropped from the Signal Service Reports some years since and are not included in many general tables, but the annual tables in which they appear show that they rank in everything with the Stations which I have given for this section.

MEAN RELATIVE HUMIDITY OCTOBER 1ST TO APRIL 30TH FROM COMMENCEMENT OF OBSERVATIONS TO DECEMBER 31ST, 1885, WITH ALTITUDE OF EACH STATION.

STATION.	Altitude.	October.	November.	December.	January.	February.	March.	April.	Mean for 7 Months.
Fort Davis	4928	55	54	54	57	49	48	40	51
El Paso	3764	55	55	55	52	48	40	33	48
Fort Thomas	2710	48	57	66	65	61	56	41	56
Fort Grant	4856	38	42	49	50	48	42	31	43
Yuma	141	44	45	50	46	45	44	42	45
Fort Apache	5050	51	56	61	63	61	58	46	57
Prescott	5389	44	51	59	57	56	51	45	52
Denver	5281	46	50	56	54	54	49	50	51
Santa Fé	7026	43	50	53	53	54	44	37	48
New York	185	70	70	73	74	73	68	65	70
Boston	124	70	71	72	72	70	70	66	70
Chicago	715	70	72	75	75	73	72	67	72
Detroit	662	71	74	78	77	75	73	64	73
Louisville	551	68	68	71	72	68	63	59	67
New Orleans	52	71	72	73	72	69	70	70	71
San Antonio	781	69	68	70	72	68	67	75	70
San Diego	63	73	68	68	71	74	75	73	72
Jacksonville	43	75	75	74	75	71	67	68	72

In the Signal Service Report, 1888, is a table of extremes of relative humidity in the United States. In the "least relative humidity" table, Fort Grant, Santa Fé, Yuma, El Paso, Denver, Fort Davis, Prescott, Camp Thomas and Fort Apache make nine of the fifteen.

COOLNESS OR COLD VS. WARMTH OR HEAT.

This proposition needs only to be stated, but I quote again from Dr. Coolidge's report : "The worst possible climate for a consumptive is one with long-continued high temperature and a high dew point. . . . An uniformly *low* temperature is much to be preferred to an uniformly high temperature."

The appended table gives the early morning, afternoon, and midnight temperatures from commencement of observations at each station to December, 1886, inclusive, Signal Service report of 1887.

REGION.	October.			November.			December.			January.			February.			March.			April.		
	Mean.			Mean.			Mean.			Mean.			Mean.			Mean.			Mean.		
	7 a.m.	3 p.m.	11 p.m.	7 a.m.	3 p.m.	11 p.m.	7 a.m.	3 p.m.	11 p.m.	7 a.m.	3 p.m.	11 p.m.	7 a.m.	3 p.m.	11 p.m.	7 a.m.	3 p.m.	11 p.m.	7 a.m.	3 p.m.	11 p.m.
Fort Davis ..	52	72	60	41	62	49	35	57	44	34	54	41	38	60	47	43	66	53	50	72	60
El Paso.....	53	75	62	41	61	49	38	56	46	36	53	44	41	60	50	45	67	56	51	75	63
Fort Thomas..	47	75	61	35	62	48	32	55	43	30	51	41	35	58	48	41	64	54	45	73	61
Fort Grant.. .	54	71	61	43	59	50	38	54	46	35	50	42	39	54	46	43	57	51	48	67	57
Yuma.	62	83	71	52	71	59	48	66	55	46	62	53	50	68	59	54	75	65	57	81	70
Fort Apache...	40	70	51	29	57	39	26	50	35	24	45	32	28	52	38	33	58	44	36	65	50
Prescott.... .	40	66	51	29	55	39	27	49	35	24	45	32	27	48	38	31	55	42	37	61	48
Denver.... ...	40	62	49	30	48	35	25	49	29	15	35	26	25	41	31	30	49	39	37	55	46
Santa Fé..	41	60	48	29	46	35	24	40	29	21	36	26	25	41	31	30	49	38	36	55	44
New York.....	52	60	54	40	47	41	36	36	33	27	33	29	25	35	30	33	41	35	44	52	45
Boston	49	57	50	37	44	38	27	33	29	23	30	25	24	32	27	31	38	32	42	49	42
Chicago	49	58	52	36	42	39	27	32	29	21	28	24	24	32	28	31	38	35	43	49	45
Detroit.....	48	58	51	35	41	37	27	31	28	22	27	24	23	31	26	29	37	32	41	51	43
Louisville... ..	52	66	57	41	50	45	34	41	37	31	38	34	34	43	38	39	48	44	50	62	55
New Orleans...	67	76	69	57	66	60	52	60	55	50	58	53	53	63	57	58	68	62	6	75	68
San Antonio...	62	79	68	52	67	57	47	61	53	44	58	50	49	63	55	56	71	62	63	78	68
San Diego.....	58	69	61	53	66	57	50	63	54	48	61	53	50	61	54	51	62	55	5	64	57
Jacksonville ...	66	76	68	57	68	60	50	63	54	50	62	54	53	65	56	57	70	60	65	76	66

No general table in Signal Service Reports gives the number of days in which the maximum temperature was below 32° or the minimum below 32°, and private Thompson, of the Signal Service, El Paso, has compiled the table appended, from October 1st to April 30th, from the yearly reports from 1881 to 1888 inclusive. Where reports are not complete, as is the case in some stations, Mr. Thompson has calculated the average.

I shall not consume time in analyzing these tables, but it is interesting to note that while the temperature falls below 32°, on so many nights at each of the stations, except Yuma, in this section, it rarely fails to rise above 32° during the day and in so dry a climate, with almost perpetual sunshine and absence of high winds, as I shall show later on, the temperature in the sunshine is exhilarating and delightful to the invalid, whenever the temperature in the shade is near 32° or the shade too cool for comfort.

The bacillus of tubercle cannot thrive in such a temperature, as "its growth entirely ceases below 82° Fahrenheit and above 107°" according to Herman Weber, who is high authority.

REGION.	Total Minimum Below 32°	Average Minimum Below 32°	Total Maximum Below 32°	Average Maximum Below 32°
Fort Davis	377	47	15	1·9
El Paso	426	53	5	0·6
Fort Thomas	474	59	0	0
Fort Grant	249	31	3	0·4
Yuma	21	2.6	0	0
Fort Apache	96	137	7	*0·9
Prescott	995	124	9	2·4
Denver	1073	132	171	21·4
Santa Fé	854	142	99	†16·5
New York	757	94	186	23·3
Boston	1041	130	261	32·6
Chicago	918	115	357	44·6
Detroit	910	114	373	46·6
Louisville	537	67	129	16
New Orleans	41	5	3	0·4
San Antonio	104	13	10	1·3
San Diego	0	0	0	0
Jacksonville	32	4	1	0·1

* For seven years. † For six years.

RAREFACTION VS. SEA-LEVEL PRESSURE.

Jaccoud, as quoted by Denison, referring to immunity from consumption says: "As to the quality of the climate which affords this immunity *Altitude* is the most important element. . . . Climates with a high altitude, having tonic and stimulating effects, can alone confer on the inhabitants absolute or relative immunity from pulmonary phthisis." Denison says: "While altitude is the governing element, all the associated favorable conditions of the atmosphere, somewhat in the order in which we have named them, seem to go hand in hand, until they reach the climax of success, in conferring a more or less complete immunity from consumption, among the residents at the given altitude."

"The question of an altitude of immunity from phthisis is important, because there is strong presumptive proof that those climatic conditions which prevail where phthisis seldom or never originates, are best suited to arrest the disease when it has commenced elsewhere."

(The altitude for each station named is given in the first table.)

I transfer from Dr. Coolidge's report the following "Consolidated table exhibiting the amount and ratio of sickness and mortality in the United States Army in the several regions, from phthisis pulmonalis."

(In reference to the following table, note particularly that Fort Bliss, which is now inside the corporate limits of El Paso,

REGION.	Mean Strength.	Number Treated.	Deaths.	Ratio of Cases per 1000 of Mean Strength.
Coast of New England	3963	19	5	4·8
Harbor of New York	9387	56	35	5·9
West Point	6901	6	8	0·8
North Interior East	3553	17	10	4·7
The Great Lakes	10·346	47	33	4·5
North Interior West	7·230	30	15	4·1
Middle Atlantic	6299	16	14	2·5
Middle Interior East	2436	6	3	2·4
New Port Barracks, Ky	1454	5	4	3·4
Jefferson Barracks and St. Louis Arsenal	5580	23	21	4·1
Middle Interior West	5319	28	13	5·2
South Atlantic	2·800	26	5	9·2
South Interior East	5·919	43	28	7·2
South Interior West	10·013	20	25	2·
Atlantic Coast of Florida	835	2	1	2·3
Gulf Coast of Florida	2299	16	3	6·9
Texas, Southern Frontier	4450	18	11	4·
Texas, Western	6324	25	12	3·9
New Mexico	5873	8	3	1·3
California, Southern	1707	9	5	5·2
California, Northern	1599	9	4	5·6
Oregon and Washington Territory	1831	6	2	3·2

is described in Dr. Coolidge's report as, "nearly opposite the town of 'El Paso'" (the former name of the Mexican town Juarez, just across the Rio Grande from the present El Paso) and is included in the New Mexico statistics, having been attached to the department of New Mexico always until late years; that Fort Davis was not established, and that Arizona and Colorado are not included in the tables.)

Dr. Coolidge says: "The statistics for West Point should, therefore, be excluded from any analysis of the results exhibited," for the reason that "the cadets are young, only admitted after rigid examination in regard to health and physical development, and remain but four years." Continuing, he says: "It will be perceived by an examination of this table, that with the exception of West Point, the lowest ratio of cases of consumption occurs in New Mexico, being 1.3 per 1000, and the highest in the South Atlantic region, where it is 9.2 per 1000. It will also be noticed that the regions designated, as the South Interior East and as the Gulf Coast of Florida, give the next highest proportions, being respectively 7.2 and 6.9 per 1000 of mean strength. The ratios for these three regions and also those for California, are higher than for any of the regions in the Northern Division."

Assistant-Surgeon G. K. Wood, one of the medical officers

whose report is included in Coolidge's report, remarks in reference to diseases of the respiratory system : "The climate of those broad and elevated table lands which skirt the base of the Rocky Mountains on the East, is especially beneficial to persons suffering from pulmonary diseases, or with a scrofulous diathesis. This has been known to the French inhabitants of the upper Mississippi and Missouri for many years ; and it has been their custom since the settlement of that portion of the country to send younger members of their families, who showed any tendency to disease of the lungs to pass their youth among the trappers of the plains and mountains. The beneficial results of this course, no doubt, depend, in a great measure upon the mode of life led by these persons—their regular habits, constant exercise in the open air, and the absence of the enervating influences incident to life in cities ; but that more is due to the climate itself, is shown by the fact that among the troops stationed in this region (whose habits are much the same everywhere) this class of diseases is of very rare occurrence. The reports from the line of posts stretching from the upper Platte, through New Mexico to the Rio Grande give a smaller proportion of cases of pulmonary disease than those from any other portion of the United States. The air in this region is almost devoid of moisture ; there are no sudden changes of temperature ; the depressing heats of the Eastern summers are never felt ; and although in the north the winters are extremely cold, a stimulant and tonic effect is the only result of exposure in the open air. It is of great importance that the climate of this region should be generally known, that the present injudicious course of sending consumptives to the hot, low and moist coast and islands of the Gulf of Mexico should be abandoned.

"In diseases of debility the remedies are tonics and stimulants. What is more debilitating than affections of the lungs and what less tonic than heat and moisture combined, as is found in the climate of the Gulf Coast ? It is simply not cold, and has no other advantage over the Northern States. The towns of New Mexico should be selected as a refuge for those showing a tendency to diseases of the lungs or scrofula, anywhere east of the Rocky Mountains and west of the region where Northers prevail."

Assistant-Surgeon J. F. Hammond, in same report, from Socorro, N. M., directly within the belt included in this paper, says: "Phthisis pulmonalis I have never seen in the country except in two instances; once in an officer in the United States Army and once in an American emigrant. It was developed in each before he left the United States, and each very gradually improved. One resided at Socorro and the other at El Paso del Norte." (El Paso del Norte is the same El Paso, now Juarez, heretofore referred to as opposite to El Paso, Tex., which then was called Franklin or Fort Bliss.)

Ex-Surgeon-General W. A. Hammond, in his treatise on Hygiene, quotes extensively from Coolidge's report, and remarks: "As the foregoing table shows, however, New Mexico is by far the most favorable residence in the United States for those predisposed to, or affected with phthisis. . . . In a service of three years in New Mexico, during which period I served at eight different stations, ranging from the extreme northern to the extreme southern part of that Territory, I saw but three cases of phthisis, and these were in persons recently arrived from the United States. Inflammation of the lungs is also very infrequent, as are likewise pleurisy and bronchitis."

SUNSHINE AS OPPOSED TO CLOUDINESS.

Dr. Denison well says: "There is little necessity for advocating the utility of sunshine. All life depends upon sunshine, and for successful existence must have it. . . . The variations for cloudiness range from 60 per cent of the time in the interior lake region down to less than 30 per cent in the southwestern portion (New Mexico and Arizona). . . . A preponderance of sunshine should be mentioned as favoring the possibility of much-to-be-desired out-door life and also the camping-out idea in summer time."

In the Signal Service report of 1888 is a table giving the 'fifteen stations of the Signal Service having the least average cloudiness, and fifteen stations having the greatest average cloudiness." Yuma, Prescott, Fort Stanton, El Paso, Fort Davis, Fort Grant, and Denver are included in the first fifteen, or "least average cloudiness." These facts render a table for cloudiness unnecessary, but I append a table of cloudy days.

STATION.	Average cloudy days per month.	Oct. Cloudy days.	Nov. Cloudy days.	Dec. Cloudy days.	Jan'y Cloudy days.	Feb. Cloudy days.	March Cloudy days.	April Cloudy days.
Fort Davis	3·8	3·8	6·6	3·3	3·3	3·3	3·9	2·2
El Paso	2·4	1·4	2·8	2·6	3·0	3·0	2·9	1·4
Fort Thomas	3·0	2·0	2·0	4·5	3·3	3·3	3·4	2·2
Fort Grant	3·7	2·0	3·1	5·2	5·0	5·4	4·2	1·0
Yuma	1·6	0·5	1·2	1·8	2·6	2·2	2·0	0·7
Fort Apache	3·7	1·7	2·7	4·6	5·1	4·9	4·6	2·6
Prescott	2·3	1·1	1·3	2·5	2·6	3·1	3·6	2·1
Denver	4·5	4·4	4·2	2·8	3·4	3·2	5·7	7·8
Santa Fé	3·7	4·1	4·0	4·1	3·7	2·0	3·5	4·5
New York	9·8	8·1	9·5	11·4	11·2	9·2	9·7	9·4
Boston	11·1	9·4	10·6	12·3	12·6	10·2	12·3	10·6
Chicago	10·8	9·2	12·5	13·0	10·7	9·4	11·1	9·4
Detroit	13·2	10·6	14·5	16·9	16·6	11·5	12·8	9·8
Louisville	11·6	6·6	11·9	14·9	14·4	11·0	12·2	10·4
New Orleans	9·1	5·9	9·2	11·4	10·3	8·9	9·9	8·3
San Antonio	10·4	7·7	9·5	10·8	11·0	11·4	11·5	10·8
San Diego	6·8	4·8	5·7	6·4	7·4	7·1	8·4	7·5
Jacksonville	7·7	7·9	8·3	8·5	0·7	7·6	5·9	5·8

Assistant-Surgeon J. F. Hammond, in his report from Socorro, heretofore quoted from, says: "During the season of twenty-one months through which meteorological observations were made, there is but one day registered in which the sun was not visible." The clouds in this section are described by Signal Officers as of the *cumulus* or *cumulo-stratus* type. They rarely obscure the sun for a whole day, as is shown by Dr. Hammond's report. The *nimbus*, "which covers the sky in seasons of continued rain, as in easterly storms, and is the proper rain cloud," is practically unknown throughout all this region. (The non-professional reader may consult Webster's Unabridged, article, Clouds.)

VARIABILITY VS. EQUABILITY.

Dr. Denison proves, by comparing "twenty-five dry and twenty-five moist prominent stations and health resorts in the United States," and the "fifteen most and the fifteen least variable signal stations in the United States," for 1883 . . . "how uniformly variability goes with dryness and equability with moisture." He claims that "variability is quite a uniform constituent of dry high climates, and that as the dryness predominates, the marked variability is less felt, and is less, if at all objectionable. On the other hand, marked atmospheric equability, wherever found, is *prima facie* evidence of excessive humidity." . . .

"It is toadyism to the mistakes of medical antiquity for equability to be any longer insisted on as a constituent of the best climate for phthisis. It is all right and essential for humid climates, but for dry, cool, and elevated resorts it is out of the question. Besides the quality of stimulation which is associated with variability, there is an important consideration in the purifying of the atmosphere which variability indicates. This happens through the alternate expansion by heat and the contraction of the air by cold, together with the nightly chilling and sometimes freezing, which regularly renders it inimical to germ life. The purity of atmosphere which is represented by warm, moist, and equable climates, is not to be compared with that purity which is represented by the opposite attributes. The first is where the temperature so continually hovers within the limits of the microbe's needs, where sound as well as heat is smothered in a short distance, and the sun's rays give a dusky red glow. The second—indicating a comparative absence of germs—is where exposed meat can cure and not spoil; where far distant objects appear near and the unobstructed rays of the sun give nearly as white a light as does an electric lamp." (In proof of the correctness of Denison's position that "as the dryness predominates, the marked variability is less felt, and is less, if at all, objectionable," note Dr. G. K. Wood's statements on former page.)

CONFIRMATORY PROPOSITIONS.

Denison's confirmatory propositions will be recognized as accurate descriptions of the Rocky Mountain region.

MODERATE WINDS.

General Greely, in his article before referred to, says:

"One of the greatest benefits to be derived from health resorts in winter is the opportunity and inducement for exercise in the open air, and since invalids shrink from chilling temperatures, there is a necessity of not only warm days, but also absence of high winds and low relative humidity, conditions which, especially the winds, tend to rapidly abstract heat from the body.

"Besides, clear, bright days, without too frequent rains, are

needed to enliven and cheer the invalid, and remove him from the depressing impressions which always result from confinement through stress of dull or stormy weather.

"Chart V. gives for fourteen stations covering the country most frequented in winter, the velocity of the winds at 3 P.M., about the hour at which the wind is at its highest. Winds below ten miles an hour may be considered satisfactory. El Paso, Charlotte, and St. Paul show the least wind. Santa Fé, San Francisco, and San Antonio are most liable to high winds."

The other stations in Chart V. are Augusta, Knoxville, Sanford, Jacksonville, San Diego, Yuma, Sacramento, and Denver in about the order named. The Signal Service reports do not give the velocity of the wind at 3 P.M., but I append for comparison a table of average hourly velocity of the wind for seven months, October 1st to April 30th, inclusive, from Signal Service report, 1885.

STATION.	October.	November.	December.	January.	February.	March.	April.
Fort Davis.	5·1	5·5	6·3	5·6	5·8	6·7	7·1
El Paso	4·0	4·4	4·7	4·7	5·9	6·5	6·4
Fort Thomas (One year only, 1886.)	3·3	3·5	2·3	3·1	4·0	5·0	5·3
Fort Grant	7·2	6·8	6·6	6·4	7·5	7·5	8·9
Yuma	4·5	5·0	4·9	5·7	7·0	5·9	6·2
Fort Apache	5·5	5·3	5·2	5·1	5·8	6·7	8·0
Prescott	5·7	4·6	5·1	5·0	6·2	7·2	8·6
Denver	5·9	6·1	5·9	6·4	6·2	7·3	7·3
Santa Fé	6·6	6·5	6·3	6·9	7·1	8·1	8·8
New York,	9·4	10·1	10·2	9·9	10·9	11·6	10·0
Boston	9·	10·3	10·	9·9	10·6	11·3	10·1
Chicago	8·9	8·5	8·6	9·0	9·0	9·7	9·5
Detroit	7·9	8·5	8·6	8·4	8·7	9·0	8·6
Louisville	6·5	7·4	7·6	7·8	8·6	9·0	8·3
New Orleans	7·3	7·9	8·1	7·9	8·6	8·5	8·3
San Antonio	4·2	4·9	4·8	4·8	5·6	4·9	4·9
San Diego	5·5	5·0	5·1	5·2	6·1	6·5	6·8
Jacksonville	6·9	6·4	6·0	5·7	6·8	7·9	7·6

An interesting point to note in the table is, that while the average hourly velocity in El Paso and San Antonio for December, January, and February is almost the same, San Antonio being in the *Norther Belt*, is, according to General Greely, "most liable to high winds," while El Paso, not being in the *Norther Belt*, "shows the least wind." None of the territory embraced in this paper is within the Norther Belt, all of it is noted for almost constant, moderate wind movement, except in the coldest weather, when it is generally calm.

PRECIPITATION.

The appended table of monthly precipitation, rain or snow, for seven months, October 1st to April 30th inclusive, from Signal Service reports, puts the advantages of this "rainless region" in most graphic form.

AVERAGE MONTHLY PRECIPITATION, OCTOBER 1ST TO APRIL 30TH, IN INCHES.

NAME OF CITY.	October.	November.	December.	January.	February.	March.	April.	Average.
Fort Davis	1·98	0·40	0·35	0·58	0·21	0·39	0·53	0·63
El Paso	1·37	0·48	0·67	0·58	0·44	0·49	0·18	0·60
Fort Thomas	0·43	0·32	1·30	0·70	1·34	1·27	0·26	0·80
Fort Grant	0·89	0·57	1·56	0·91	1·26	1·32	0·23	0·96
Yuma	0.12	0·18	0·40	0·41	0·53	0·22	0·11	0·28
Fort Apache	1·67	0·99	1·94	1·52	1·97	1·74	0·79	1·52
Prescott	0·55	0·78	1·72	1·44	1·33	1·57	0·92	1·19
Denver	0·72	0·77	0·74	0·64	0·50	0·97	2·10	0·92
Santa Fé	1·03	0·87	0·82	0·52	0·65	0·58	0·68	0·74
New York	3·36	3·52	3·21	3·76	3·69	3·88	3·27	3·53
Boston	4·22	5·01	3·54	4·44	3·85	4·61	3·87	4·22
Chicago	3·68	2·77	2·26	2·16	2·27	2·74	3·48	2·77
Detroit	2·62	2·46	2·73	2·10	2·33	2·61	2·34	2·46
Louisville	3·32	3·89	4·30	4·26	4·51	4·08	4·52	4·13
New Orleans	3·17	5·28	4·87	5·84	4·01	6·15	6·14	5·07
San Antonio	2·24	1·58	1·79	1·27	1·99	2·39	3·05	2·04
San Diego	0·41	0·73	2·09	2·05	2·36	1·50	0·94	1·44
Jacksonville	5·99	2·82	3·29	3·61	3·40	3·50	3·28	3·69

SUMMARY.

Dr. Denison says: "The preferable climate for the great majority of consumptives in the United States varies according to the case, from 1500 feet elevation in the north in winter, to 10,000 feet as a possible extreme in the southern portion in summer."

In Buck's "Reference Handbook of the Medical Sciences," under article, Arizona, the statement is made, based upon reports of medical officers of the United States Army, that "The exceptional dryness and purity of its atmosphere, the wonderful clearness of its skies, and the very small number of rainy days there occurring, would all seem to point to the desirability of the Territory of Arizona as a health resort for patients suffering from pulmonary phthisis, or from other diseases of the respiratory system. . . . The climatic advantages of Arizona are almost identical with those to be found in New Mexico."

Under article, New Mexico, it is stated that "The data for Fort Bliss and El Paso do not, strictly speaking, belong in a chart representing the climate of New Mexico; nevertheless, I include them, because, while El Paso lies across the Texas boundary line, it is but a few miles beyond that line and, climatologically considered, belongs quite as much to New Mexico as does Fort Selden."

In same article: "The reader's attention is called to the extraordinary cloudlessness of the sky at El Paso."

Silver City is mentioned as "enjoying the exceptional advantage of shelter from wind." Under general remarks in same article, it is stated that "below the thirty-fifth parallel the winters become mild."

I think that I have proved from the records of the Surgeon-General's Office, that Denison's propositions are correct. Admitting this, I have certainly shown from the Signal Service records, that Texas west of the 104th parallel of longitude, and New Mexico and Arizona south of the 35th parallel of latitude, furnish by far the best winter climate in the United States for consumptives.

The President.—I suppose if any discussion of this paper is to be had, it would be courtesy to Dr. Yandell to have it now before he leaves the city.

DISCUSSION.

Dr. F. I. Knight, of Boston.—I think we all ought to be thankful to Dr. Yandell for the facts which he has given us. There is no need to urge upon this audience the value of the climate which we get in the Rocky Mountain region. There have been times in previous years when I was obliged to speak to a differently tempered audience, but certainly Dr. Yandell does not here need any supporters for his proposition.

I have long been satisfied, from my own experience, of the fact that the cool, dry climate was the one for tuberculosis. While I have had patients do well in all kinds of climates, and have had them recover by staying at home, under the worst conditions sometimes (but those were exceptional cases), by far the larger proportion of my cases, where the disease has been arrested, has recovered under those conditions which have been set forth by Dr. Denison and others.

There is a question in my mind whether in the increase of population the tendency will be to keep the conditions good, or whether some less populated district, at any rate, less populated places than those we have been in the habit of using here, might not be in the future the better ones ; and it certainly behooves those people who are interested here in the mountains, and the reputation of these places, to see that their sanitary conditions are kept good ; because it is said that in the mountain regions of Georgia, which have been supposed to be free from tubercular diseases, the disease has become common with the increase of population. So I believe if the tubercular germ should ever get into Iceland—and that is one of the best arguments on the specific nature of the disease, that the people of Iceland live in the worst possible conditions, live in the wettest and coldest conditions, live in huts with no pure air and are entirely exempt from tubercular diseases—I believe if the germs should once get in there, we should find it would be particularly prone to the disease. So, in regard to the better situated

climates, it is necessary for those conditions to be kept as good as possible and to be kept free from the supplementary causes, we may say the accessory conditions, which will help to propagate the disease, and, as I have known in some places, to propagate it rapidly.

Dr. E. Fletcher Ingals, of Chicago.—Mr. Chairman, I have no doubt that all the bad things that have been said about Chicago are true, but I want to say this of Chicago, I frequently tell my patients it is the best climate in the world, as they can find anything they want there in the course of a week, and that is usually true.

I want to ask the author of the paper one thing that does not come strictly under the head of his paper : How about the opportunities for patients obtaining the comforts that are necessary in this climate ? I am fully convinced that the belt he speaks of is excellent ; personally I agree with his conclusions. I like this particular locality of New Mexico and Arizona better than any other for winter, but I have always felt some hesitation in telling patients to go there, fearing they would not be able to obtain the desirable comforts.

Dr. W. M. Yandell.—With regard to accommodations for invalids, I would say that El Paso is the largest city in this region. The hotels are superior to those in the East in cities of like population, say 10,000, as the city has five trunk line railroads. Furnished rooms easily had and good restaurants. The market is excellent at all seasons ; excellent milk, beef, and mutton always to be had ; venison, antelope, fish, and oysters, fruits and vegetables, in their season. Good accommodations may be had, I believe, at any of the towns on the railroads in this region.

The Galveston, Harrisburg & San Antonio Railway from the South, and the Texas & Pacific from the East, come through western Texas into El Paso. The Southern Pacific, leaving El Paso, runs through southern New Mexico and southern Arizona ; the Atchison, Topeka & Santa Fé from the North comes directly through New Mexico to El Paso, and the Atlantic & Pacific run through New Mexico and Arizona, about on the line of the 35th parallel. All are first-class roads with sleep-

ing-car and other comforts on all trains, and all points in this region may be easily reached by some of these lines.

During the reading of the paper the doctor paused to remark that he had spent four years in the Sandwich Islands, and that he thought that one going there in search of health becomes depressed by the high degree of moisture which exists there, and feels the want of tonicity in the air which we get in the mountain climates. He said that he believed that invalids should have the tonic influence of cold rather than the depression which one gets in climates so even from month to month.

Dr. Standart said that Professor Marcus E. Jones, of Salt Lake City, had some charts which would well illustrate the paper just read, and being asked to read them to the Society he did so, first saying that the question with him was one of fact, simply a scientific question.

Professor Jones explained that the charts were prepared for another occasion, hence they were too small to be readily seen by the audience. After presenting his individual opinions on altitude, temperature ranges, etc., he said : " I have prepared a table showing the range of temperature of Denver, Salt Lake City, New York City, the coast cities, and the interior towns, the southern plateau, San Antonio, Texas, and Yuma, Ari. These tables are prepared from the records of the Signal Service, and furnished me by General Greely himself. In this table El Paso's range the year round is enormous. . . . The least range of temperature is in January, and is 27 degrees, while in summer time it runs up to 35, and then goes down to 28 in the fall and winter. The range of Yuma, Ari., is just about as high as that at El Paso. The range of temperature of these two places is greater than that of any other locality mentioned. Now, at Salt Lake City the range of temperature is, to my mind, the best of any locality, from the fact that in winter the range of temperature is only 16 degrees. Winter is a time when we do not want a changeable climate, since it is cold, disagreeable, and unhealthful. A reasonable range is very grateful in the summer time. At this time of the year Salt Lake City has a greater range of temperature than any other place, save Denver. In Denver the range is a degree and one-half more than at Salt Lake City, but 62 per

cent greater in the winter time, being only 5 per cent greater in summer.

"In New York City, Jacksonville, and Los Angeles the range is far less than in these northern plateau regions. The uniformity is due to the influence of the sea. The wind movement has very great bearing upon the healthfulness of a place, especially if the movement is rapid.

"This diagram shows the wind movement, and it shows that that of Salt Lake City is less than that of any other place which I have mentioned. In January and February it is two thousand miles less than that of Denver at the same time. In other words, the wind movement of Denver is 60 per cent greater than that of Salt Lake City in the winter. In spring it is 23 per cent greater, in summer 7 per cent greater, and in fall 44 per cent greater.

"The rainfall diagram shows the precipitation of all these places for every month and season in the year.

"In Salt Lake City the most rain falls in the winter. It is the exact opposite in Denver. So Denver, in the winter, has the advantage of Salt Lake City It is the only thing in which it has the advantage of Salt Lake City.

"At El Paso, for example, the rainfall in the summer time is valuable, provided it does not exceed a certain amount, but if it is very high, and the temperature is very high, the relative humidity is also high, and the atmosphere is therefore exceedingly oppressive. The rainfall of Salt Lake City is 14 per cent less than that of Denver in the summer time. Salt Lake City, therefore, has the advantage in the matter of small humidity of 21 per cent over Denver.

"In the matter of mean temperature it is the general opinion that Salt Lake City and Denver differ widely from Eastern cities, but it is not so. Des Moines, Ia., New York City, Denver, and Salt Lake City are almost identical in their mean annual temperature every month in the year. There is not a variation of a degree and a half in any month between these places. Taking the relative humidity of Salt Lake City in the summer time, we find it is a trifle over 36 degrees. Denver at the same time is 47 degrees. The relative humidity of Salt Lake City in the winter time will range about 60 degrees; of Denver it will be a trifle less than 56 degrees. The

relative humidity of San Antonio, Tex., is away up among that of the coast towns. I have put in El Paso and San Antonio, Tex., at the suggestion of some of the physicians whom I met at Salt Lake City, members of the Association. San Antonio, I believe, claims to be a sanitarium for consumptives. I do not see how it can possibly make good that claim, for its relative humidity is almost identical with that of New York City. In a paper read yesterday the advantages of El Paso, Tex., were brought forward, probably all the advantages which could possibly be urged for El Paso, and some of its disadvantages. The gentleman spoke of El Paso as a winter resort, but he said nothing in regard to it as a summer resort. The diagram which I have here shows that the relative humidity of El Paso in the spring is lower than at any other place on my list. In the summer time it is higher than Denver, Yuma, or Salt Lake City by over 50 per cent. Consequently, although it is true that El Paso and Tucson, Ari., are far superior to either Denver or Salt Lake City as winter sanitariums, they are of no consequence as summer resorts. The minimum temperature of El Paso and San Antonio is almost identical with Jacksonville, Fla. The maximum temperature of El Paso runs almost out of sight in the summer time. In other words it runs up over one hundred degrees, and for three months it is over one hundred degrees. There are days when it runs up to one hundred and ten and more."

Dr. S. E. Solly, Colorado Springs, Col.—The gentleman who has just spoken has dogmatized on several subjects, which our present knowledge does not permit us to speak so positively about. Thus, he has asserted as a fact that altitude is a drawback in the treatment of consumption. The opposite is, in my opinion, more likely true. But, however, in either case, it can only be an opinion, not a dogma. You cannot prove either opinion, as you cannot separate altitude from the other accompanying conditions of an elevated climate, such as sunshine and purity of air, which are on all hands admitted to be of value. This gentleman speaks also of rainfall and humidity as if they were synonymous terms. We know as a fact that we may have in one place a considerable annual rainfall with less average humidity of the atmosphere than in another

where there is only a small rainfall. We know full well that, as a general law, with increase of elevation comes lessened humidity independently of, at the same time, a possible increase of rain and snowfall. Some of the effects of altitude upon phthisis, then, must be by its increased dryness. With regard to the tenuity of air, it is proved by mechanical reasons that it increases the activity of the lungs. Here, then, is an influence which is admitted as a general principle as desirable in the treatment of phthisis. However, even if it is true, as I believe, that elevated climates are the best for most cases of phthisis, it by no means follows that it is beneficial to all, as phthisis may occur in any class of physique and temperament. There must necessarily be some, to whom such elements as rarefaction, variability, or extreme dryness are inimical, with respect to stimulating their general vitality as regards the stage and form of the local disease. The question will arise whether they require the stimulus that altitude imparts to the life of the organ or not. Thus we see, although elevated regions may be best for the majority, in so many-sided a disease as phthisis, many kinds of climatic conditions are needed to suit all cases.

Dr. H. B. Baker, of Michigan.—I fear that if I were to speak on the subject, I should be tempted to do as Dr. Solly did, to speak with reference to opinions given. I like very much the attitude with which the speaker started when he said he was prepared to give us facts, and then leave the conclusion for us to draw, and I think we ought to be thankful for the facts with regard to Salt Lake City, both to Dr. Standart and Professor Jones. It seems to me, however, that just as soon as we begin to say that one place has the advantage of another, we are assuming just what we came here to learn. I think we know very little about those topics. Dr. Solly, and those of you here who have made a special study of it, know more about it, perhaps, than we do. But those of us at a distance have a difficulty in coming to a conclusion. We have abundant conclusions given us, but when we come to reach for the facts we do not find them. It seems to me we lack one element in what has been given us by Dr. Standart and Professor Jones who followed him. We lack the exact facts as to what deaths have occurred, in what months ; and until we get these

statistics of sickness and of deaths—until we get these facts, we are all at sea. The more we can have of tabulated material given to us in the form of charts and diagrams, the better; but that constitutes only one side. Some way or other the people in this western country, it seems to me, ought to give us the facts with regard to cases of sickness and to deaths. When did they occur? in what month? how many of them? what ages? and follow out the method with reference to sickness as well as to deaths.

IS HERPES ZOSTER A CAUSE OF PLEURISY AND PERITONITIS?

By Roland G. Curtin, M.D., Ph.D.

This interrogative is the title of my paper, and my desire is to attract attention to the subject, in order that observers and investigators in the future may be enabled to reach definite conclusions. In the autumn of 1886 I delivered a lecture (a portion of which is here embodied) at the Philadelphia Hospital, in which I gave some personal experiences with zoster associated with internal lesions. I will now quote from the report of the lecture (which, however, was never published).

About fourteen years ago I saw a case at the Hospital of the University of Pennsylvania, in which one-half of the mucous membrane of the roof of the mouth, on the right side, was covered with vesicles. These vesicles stopped short at the median line. The appearance in color and size was as if the mucous membrane was studded with boiled sago granules. I showed the patient to Dr. Van Harlingen, one of the Dermatologists of the University Hospital, who pronounced it to be an undoubted case of herpes zoster of the mucous membrane, a very rare location. The vesicles had been preceded by the usual neuralgic pain, and the eruption itself had the same burning pain experienced when the disease is situated on the skin.

Three years after my experience with this case, involving the mucous membrane of the mouth, I had under observation a maiden lady, who, in answer to the question, "How old are you?" replied in a low voice, "to you I am sixty, but to other people I am fifty-six." She was in the later stages of locomotor ataxia, so that she could scarcely walk. While in this condition, she was attacked with a short, intermittent, neuralgic pain in her side, at the left base of the chest. A careful examination failed to develop any physical signs of pleurisy. In due time the pain was followed by a well marked zoster, which satisfied me that the pain was preliminary to the

herpetic eruption. About the time this eruption appeared, I noticed a pain with every inspiration, like the "catching pain" of pleurisy, associated with considerable consitutional disturbance, and dry, hacking cough. A little later my attention was called to the diminished movement of the left side of the chest, which was almost immobile, and a careful physical examination revealed an effusion which half filled the side of the chest. This effusion continued until the chest was entirely filled. The fluid in the chest disappeared in a few weeks under appropriate treatment. The question was at once raised, in my mind, as to whether the serous membrane of the cavity of the chest might not be susceptible to the same influences as the mucous membrane.

Within the same year I had another case, which seemed to bear upon the same subject, apparently, an inflammation occurring in another serous membrane simultaneously with zoster. A woman, thirty-five years old, who was about four months pregnant, had what I diagnosticated as a localized peritonitis, occurring simultaneously under the seat of a zoster eruption. A lancinating neuralgic pain was located on the right side of the upper part of the abdomen, just below the margin of the liver. There appeared later at the same position a well-marked clustered eruption. About the same time a deep-seated soreness and tenderness extending to the median line. The febrile symptoms were marked, respiration and movement caused a great increase in the pain, which was constant, and pain was caused by the flatus (which was present) passing through the bowels. She barely escaped aborting. Later on the uterus increased in size, and caused much pain, which was relieved, but not entirely so, when she was delivered. It was some months before the soreness entirely disappeared.

The questions raised by these cases are as follows:

1st. Was the internal disease a zoster eruption of the serous membrane?

2d. Was the inflammation of the internal filaments of the nerve communicated to the pleura and peritoneum?

3d. Did the internal inflammation cause the zoster?

4th. Were both troubles independent and simply coincident?

Answers to the first two questions would seem to be impossible, as the data are not sufficient to warrant a conclusion.

In answer to the third question, I would state that the internal symptoms followed the neuralgic pain, which was the first symptom noticed, showing that the internal disease was secondary to the external.

In answer to the fourth query, I think we can say that the disease of the serous membranes seemed to be immediately under the seat of the skin eruption, which would make them appear to be associated and, further, the internal inflammation seemed to occur during the stage of eruption.

Let us inquire into the pathology of herpes zoster. Dr. Van Harlingen, in his "Handbook of the Diagnosis and Treatment of Skin Diseases," 2d edition, 1889, says: "Its etiology is obscure, but it is well recognized that the disease is dependent upon a peculiarly irritable or inflamed condition of the cutaneous nerve-trunk and branches. In some cases, the disease consists in an inflammation of the spinal or other ganglia, the influence of which is carried forward, along the nerves, to their termination upon the skin."

By this definition you will perceive that an inflamed condition of the filaments of the nerves is believed to be present in zoster. It does not require much stretch of the imagination to suppose that the same inflamed condition might be present in the filament of the nerves distributed inside the chest and abdomen, thereby causing an eruption or an inflammatory condition of the serous membranes.

Some writers upon pleurisy have sought to account for the characteristic pain in the side, (which, as is known, frequently causes such anæsthesia of the cutaneous branches of the intercostal nerves as to cause the patient to shrink even from pressure with the fingers) by suggesting the likelihood of an extension of inflammation from the parietal pleura, so as to involve the neurilemma of adjacent costal nerves.

Such an extension of inflammation might readily be the cause of the herpes zoster occurring in our present case. For, although herpes zoster is usually connected with inflammation above the nerve ganglia, it is almost certain that it may also occur as a result of injury or inflammation along the nerve-trunks.

Zoster is found associated with phthisis, general tuberculosis, cancer, pneumonia, and various other chronic and acute dis-

eases. It is not infrequently associated with traumatism. A man under my care, aged 54, in the last stages of cancer of the œsophagus had neuralgic pain at the base of the left chest, followed by copious eruption of the herpes zoster. This was one month before he died. A post-mortem showed that the cancerous affection involved the middle portion of the œsophagus, and the surrounding tissues in the mediastinum were secondarily affected. Dr. George H. Rohe, of Baltimore, a member of this society, informed me that he had zoster as a complication in a case of croupous pneumonia.*

The difficulties in the way of recognizing an internal disease associated with zoster are as follows:

1st. The surface manifestations would be looked upon as sufficient to account for the pain and constitutional disturbance noticed by writers as sometimes present.

2d. The severe neuralgic pain generally present, and the burning and soreness of the outer surface of the skin in the state of eruption, would seriously interfere with a careful examination by physical diagnosis.

3d. The soreness and neuralgic pain sometimes noticed, especially in the aged, on the surface, after the eruption has disappeared, might mask the symptoms of the later stages of associated internal disease.

4th. The herpetic eruption not being accompanied by any exudation externally, an effusion would not be likely to follow an eruption located internally.

5th. Death is not like to follow pleurisy or a localized peritonitis produced by an internal eruption, so that a post-mortem examination is almost out of the question. If the opportunity offered, the eruption might be so modified by the pleural or peritoneal inflammation and exudation as to be unrecognizable.

I have looked over much literature, both old and new, relating to herpes zoster and lung diseases, and I find very few allu-

* While on the subject of the causes of herpes zoster, I will state that in the late epidemic of influenza (1889–90), I noticed three cases of herpes zoster complicating this disease; and Dr. George A. Rex, of Philadelphia, had five cases; and Dr. E. P. Bernardy noticed six cases; thus leading to the assumption that the influenza, with its many nervous and inflammatory manifestations, was a cause of zoster.

sions to the subject under consideration. Polzin, in an inaugural dissertation, published in Berlin, in 1884, says: "It is well known that thermic influences have great importance in the production of skin diseases, and in particular herpes zoster. This will account for the frequent concurrence of zoster with acute inflammatory affections of the respiratory organs, particularly pneumonia and pleurisy."

It appears that this gentleman, in his thesis, is the only one that has alluded to the subject of herpes zoster in connection with pleurisy. No cases seem to have been reported, nor does any other author allude to the subject, so far as I can learn.

Pitres & Vaillard: Cont.:

In the case of a woman of thirty, dead of pleuro-pneumonia, herpes zoster was found occupying the sixth right intercostal space in the form of advanced vesicles. (Concl., etc., "Ann. de Derm.," 1884, page 46.)

Chandeleux: "Obs. sur les lesions nerveuses dans le Zona." A woman died of phthisis. Zoster of the upper left side of chest, one month, up to time of death. Firm adherences to left lateral face. Dr. Walshe, in his work on diseases of the lungs, referring to intercostal neuralgia, says: "The obstinate pain which sometimes occurs as a sequence of herpes zoster seems to be an intercostal neuralgia." In a foot-note to the paragraph, he adds: "I have known this pain resist every conceivable remedy for upwards of three months, and profoundly affect the general health. Admitting it to be an intercostal neuralgia—an idea, however, not unopen to objection, what is the mechanism of this? Romberg's suggestion, tracing it to morbid changes in the blood-vessels of the intervertebral foramina influencing the contiguous nerves, seems to me rather fanciful than satisfactory."

There would seem to be some doubt in the mind of Dr. Walshe with regard to the cause of the severe and long-continued symptoms associated with marked general symptoms.

Jaccoud, in his work on phthisis, speaks of "the herpetic form of phthisis." My friend, Dr. Van Harlingen, informs me that the skin disease here alluded to is eczema and not herpes. It refers to those cases where eczema ceases and phthisis supervenes, a "recession," as it was formerly called

Pleurisy and other inflammations may occur with zoster, but

the misleading symptoms so mask those of serous inflammation, that they may be passed by unobserved. In the case reported in the lecture, I would never even have suspected the internal disease, had not a serous effusion taken place.

In zoster we are informed by writers on the subject that there may be sometimes considerable fever. The small amount of inflammation of ganglia, nerves, and skin, would hardly warrant so much constitutional disturbance, therefore may we not be pardoned if we suspect that internal inflammation may be present at least in some of these cases? And this is the reason that I wish to call attention to the subject, so that others may be on the alert for such internal complications.

The primary neuralgic pain of zoster would conceal the "catching" pleuritic pain, dwarfing the respiratory movements of the chest. The soreness of the inflamed nerve, and the tender skin during the stage of eruption, would prevent the examination of the chest by percussion, and auscultation might be entirely omitted under the supposition that the symptoms were due to the skin and nerve affections.

It would seem from the foregoing reports that in some cases the internal inflammation favored the zoster, and it is easy to suppose that inflammation may be caused by the zoster.

TRANSACTIONS OF THE SEVENTH ANNUAL MEETING OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION, HELD AT DENVER, COL., SEPTEMBER 2, 3, AND 4, 1890.

REQUISITES FOR A CLOSED SANITARIUM IN COLORADO.

By J. H. Kellogg, M.D., of Battle Creek, Mich.

In the few weeks which have elapsed since I received from your President an invitation to prepare a paper upon the above subject, my time has been so thoroughly occupied by the professional and administrative duties incident to the care of a sanitarium with more than four hundred inmates, that I have found it impossible to give the amount of time to the preparation of this paper which the subject demands, and have only attempted to give, in what I fear is rather crude form, certainly without any attempt at literary finish, the result of my experience during the last fifteen years in undertaking to build up a sanitarium upon rational principles. I was led to undertake this work partly by a remark made many years ago by Dr. S. Weir Mitchell, in an address before the American Medical Association, to the effect that he recognized a large class of chronic invalids who could only be treated in a properly conducted sanitarium, but that, unfortunately, he knew of no such institution in the United States under scientific management. I determined to undertake the task of supplying this want, and in my efforts in this direction have endeavored to avail myself of such knowledge as could be obtained by observations in the leading hospitals and other medical institutions of this country and Europe.

I shall present in this paper an outline of the ideal conception of a scientific sanitarium which I have formed, and which I have earnestly endeavored to embody in practical form, so far as natural conditions have rendered possible, adding some points which it seems to me are especially essential for an institution located in Colorado.

The first thing essential for such a medical establishment as this paper contemplates is a true conception of the purpose of a sanitarium. This involves an appreciation of the relation between health and disease, getting sick and getting well, and of the relation which the physician and his art should sustain to the sick. As Professor Bouchard has well said: "*Nous vivons dans un temps ou il est bon de vivre, quand on s'interesse aux choses de la medecine.*" ("To one interested in things pertaining to medicine, the present is a good time in which to live.") Within the last twenty-five years medicine has made more progress in those lines, the development of which may some time render it worthy to be called a science, than in as many centuries previous. The field of medical thought has been so covered with the fragments of medical idols and fetiches, cast down from the shrines where they have long received homage, that to some minds the perspective has doubtless revealed naught but chaos, and the iconoclastic clatter presents to such ears only a confused and senseless jargon. But one to whom the study of medicine is an investigation of principles rather than a mere collection of formulæ sees rising from the tombs of the ancient dogmas and superstitions which constituted the empirical medicine of the past, the form of a new science—rational medicine—surrounded with a light whose brilliancy illuminates the dark recesses of etiology, and reveals a pearl-covered bottom in pathological depths hitherto regarded bottomless. Such a one is able to distinguish, rising high above the Babel of confusing and incoherent controversy, the clarion voice of Truth proclaiming a new gospel, or rather the resurrection of an old medical faith, the foundations of which are old as Æsculapius and Hippocrates, though long covered up with the rubbish of mediæval philosophy.

The sanitarium is a product of modern medical progress, and ought to represent rational medicine in its most advanced and most progressive form. The central and fundamental idea in such a place should be the thought that health-getting is not a matter of magic nor of pill-swallowing, but, rather, a matter of education. The average chronic invalid is sick because he has neglected to supply the conditions requisite for health, or because he has, by long-continued addiction to bad habits, trained some of his bodily functions or structures into

ways of bad behavior. The cure of such a patient must consist chiefly of a course of systematic training by which he will be educated out of bad ways into better ones. This course of training must include such a discipline as will influence every disordered function. It will involve an absolute control of the invalid's entire regimen. His whole course of life must be systematically conformed to such rules as will efficiently and curatively modify disordered processes. Health is a matter of growth and development akin to the growth of a tree. By modifying his nutritive processes, the chronic invalid may be grown out of disease into health. By raising his whole vital status, improving his general physical tone, the morbid conditions are left behind, the normal vital rhythm is established, and health comes, not by a process of ingenious antidoting by the administration of physic, but as the result of the working in the body of that occult force recognized by the ancients, but apparently almost forgotten in modern times, the *vis medicatrix naturæ*. For nearly two thousand years medical men have occupied the greater share of their time in searching for medical specifics or antidotes for human maladies. Rational medicine teaches the physician to direct his attention to the patient rather than to his malady. It is the patient we must seek to cure and not his disease. Cure the patient and the disease has vanished ; but, on the other hand, one may cure the malady to his satisfaction while leaving the patient worse off than before. "Cured to death" might appropriately be written on many a death certificate, when more attention to the patient and less to his disease, more thought about regimen and less of medication might have rendered a death certificate unnecessary. A sanitarium, then, ought to be a place where health is cultivated, where the sick are reformed from their unhygienic modes of living, and taught to do works of supererogation healthward. The nerves must be trained to self-control. The neurasthenic must be taught how not to squander nervous energy, and how to cultivate nerve tone. The hysterical and the hypochondriacal must be shown the injury arising from introspection and self-centring of the mind, and must be cajoled into a healthy activity of mind and body. The man with a weak stomach or a weak liver must be taught how to give his stomach or his liver an easy time. The

chronic pill-swallower must be weaned from his doses. The peripatetic valetudinarian must be enthused with an ambition to become something better than a museum of maladies, and must be jostled out of his invalid ruts. The woman who takes an inventory of all her symptoms every morning, lest one should have escaped over night, must be inspired with a wholesome hatred of disease, and an earnest determination to escape from its thraldom. The whole place must be filled with sturdy ideas about health and wholesome living. The very atmosphere must breathe of health, and every room must be illuminated with mental and moral sunshine.

So much for general principles. Now let us come to particulars. The material conditions of a sanitarium must be of the most healthful character. It must be well located. Its site must be such as will secure in its vicinity a dry and well-drained soil and good air, free from smoke, dust, malaria, and poisonous emanations of every sort. The climate must be adapted to the class of patients to which the institution is especially devoted, or if all classes are received, excessive heat and dampness are qualities the least to be coveted. For pulmonary cases, a cool, dry climate is especially to be desired, and, indeed, the same might be said of a large proportion of all classes of invalids. I have long been satisfied that equability of climate is by no means to be so much desired as is generally supposed. The dead level of perfect climatic equability results in a loss of that power of adjustment to changing meteorological conditions, which is one of nature's most effective means of defence against perturbing influences of many sorts. A cold snap is the best of tonics, a sort of vital gymnastic which jostles the flagging energies into renewed activity and cultivates in the body the power of self-defence.

As regards location, it is always highly desirable that facilities should be afforded for pleasant walks and drives in the immediate vicinity. Easy mountain climbing is an exercise of great value, in the absence of which, however, the treadmill may be used as a prosy substitute.

Given a proper location, the construction of our building is of first consequence. A building is wholly unfit for a sanitarium, unless it has been constructed with special reference to the purpose of such an institution. The word *sanitarium* has

almost lost its significance through the abuse to which it has been subjected in being put up as a sign over almost every little hotel or tourists' resort, which, failing of financial success, has adopted this means of capturing invalids. The ruse does not always work, however, as I found a few years ago, when on a visit to Florida for the purpose of studying the advantages of that State as a place for a winter sanitarium. I found a small hotel which had been obliged to abandon the scheme referred to, owing to the fact that the negro runners who swarmed about the depot on the arrival of trains, insisted on shouting at the top of their voices, "All aboard for the cemetery," a corruption of the word *sanitarium* which was more appropriate than profitable to the proprietor. Our building may be constructed either of wood, brick, or stone; but it must have hollow walls, and the more nearly air-tight the walls are the better. Rooms must be of sufficient size, and the building must be so planned and placed as to secure the largest possible amount of sunlight for sleeping-rooms. Floors should be of hard wood, not carpeted, rugs being employed wherever floor covering of any sort is needed. Wide balconies commanding beautiful landscape views are of great service. Sewerage and plumbing must be most carefully planned and executed. No stationary wash-bowls or closets should be allowed in sleeping-rooms. Such conveniences should be placed in as isolated a manner as possible, and the sewer should be so thoroughly ventilated as to prevent any accumulation of sewer gas.

VENTILATION.—The ventilation of a building designed for a sanitarium or for a hospital is a matter of the utmost importance. The arrangements for the supply and warming of fresh air should be such as to make their action automatic and continuous. Fresh air should be admitted to the halls and taken thence to the rooms, from which it should be carried out by a separate foul-air duct leading from each room directly through the roof. Five or six thousand cubic feet of air per hour is not too great an allowance for invalids. This amount may be easily secured, and without drafts, by the proper placing of inlets and outlets.

Ventilating fans of the disk type, capable of handling large

volumes of air without too great velocity, are of great service, especially as a means of combating the influence of adverse winds.

WATER SUPPLY.—An abundant supply of pure water is essential. The best water for the purpose of a sanitarium is one which is as free as possible from foreign matters of any sort. The greatest possible freedom from organic matter is absolutely necessary. A small amount of inorganic matter, such as salts of lime, may be tolerated, but the absence of even these is rather to be desired than otherwise. Even distilled water has decided advantages for certain classes of invalids. Certainly such water as has been appropriately described as having "a taste of the sea and a smell of perdition" is not to be commended for the use of a sanitarium.

FACILITIES.—The word *sanitarium* or *sanitorium*, in its original application, meant simply a resort for invalids, and comprised nothing more than a comfortable home in a salubrious climate. In its modern use the best representation and ideal sanitarium must be more than this. It must be equipped with facilities for the employment of all rational remedies which may be usefully employed in the treatment of disease, special prominence being given in a sanitarium for Colorado to such as are applicable to the treatment of pulmonary diseases. In harmony with the idea that nature is the great curative force, and that a sanitarium should be a place for training the individual out of disease into health, it is evidently necessary that such an institution should be provided with most ample and most excellent facilities for the employment of such natural agencies as water, air, sunlight, electricity, and exercise, together with mechanical and instrumental appliances of every useful sort. Ample bathing apartments should be provided in which facilities will be afforded for the employment of hydro-therapy in every form—not only full baths, but sprays, showers, douches, vapor, and Turkish baths, as well as all the minor applications of this valuable therapeutic agent. A tuberculous patient will not bear too free use of water, especially at extreme temperature, but under discreet management there is no one agent of greater value in the treat-

ment of tuberculosis, and none which is more indispensable in the management of many other forms of tuberculous diseases than this agent, which has often been brought into disrepute by indiscreet or empirical use. When used with due regard to the patient's condition, and with a thorough appreciation of its potency for mischief as well as for good, water becomes an agent of the greatest utility in the management of a large number of pulmonary cases.

Special attention should be given to the ventilation of bathrooms, the air of which is peculiarly likely to become exceedingly foul, unless such attention is given to this matter. My rule has been to supply a sufficient quantity of air to bathing apartments to give each patient at least eight thousand cubic feet of air per hour. This amount is necessary to maintain the high degree of purity essential to health, and to prevent the exhaustion often experienced by a person whose lung capacity is limited, as the result of spending an hour in a close, unventilated bathing apartment, the good effects which might have been obtained from the treatment administered being thus more than counteracted by the depressing effect of the poison-laden atmosphere.

Facilities for the employment of electricity in all useful forms are essential to a well-equipped sanitarium. I have for fifteen years made use of electricity in this class of cases, employing various forms of current—galvanic, faradic, dynamic, and static, and with good results. Faradic electricity is of great value as a means of strengthening the respiratory muscles. Galvanism applied with large electrodes and high doses is an excellent means of stimulating the absorption of inflammatory products as the result of pleuritic or parenchymatous inflammation of the lungs, and it is also useful as a means of stimulating the absorption of fluids in the chest cavity. A galvanocautery is indispensable in the treatment of nasal and pharyngeal troubles, and electrolysis may also be employed in the removal of neoplasms of the nose and pharynx. From some experiments which I have made I believe that the galvanic current may be usefully employed in connection with the wheatstone bridge and the potentiometer, as a means of exact diagnosis in the treatment of some forms of intrathoracic disease, as well as in cases of morbid growths of the abdominal

cavity, through the difference in electrical resistance shown by morbid and healthy tissue.

I am sure that the lack of appreciation of electricity as a therapeutic agent, especially as regards the galvanic current, is due to inattention to proper dosage, and especially the employment of too feeble currents in cases in which strong currents should be used. Galvanism can only be used properly by the aid of the milliamperemeter, and I also find the coulombmeter of value as a measure of the amount of work done.

Static electricity is one of the best means of relieving the nervous symptoms from which phthisical patients suffer. My acquaintance with this climate is not sufficiently intimate to enable me to judge of the relation the considerable electrical disturbances to which it is subject may bear to the human system, or what relation electrical changes in the atmosphere may bear to the treatment of disease ; but from observations elsewhere, I believe that such atmospheric changes do affect, unpleasantly, persons who, by constitutional idiosyncrasy, or as the result of morbid physical states, are abnormally susceptible to variations in electrical potential. Possibly static electricity may prove an excellent means of combating this influence.

I have for many years employed an alternating dynamic current as a means of exercising the muscles of respiration as well as other muscles, and find this variety of current exceedingly useful for this purpose, as very vigorous contractions of the muscles can be obtained without the slightest pain, or no other sensation than that produced by muscular action.

The galvanic current is also a most excellent means of relieving pleuritic pain, intercostal neuralgia, and other pains which accompany affections of the chest.

The electrical department of a sanitarium should include, in addition to portable faradic and galvanic batteries, a dynamo capable of producing a current of at least ten ampères, and an electromotor force of one hundred volts. A small alternating current dynamo, a storage battery for use in connection with a large dynamo, a large static electrical machine, rheostats, milliamperemeters, and other instruments for electrical measurements, appliances for galvano cautery and electrolysis, and, with the rest, a good medical electrician, capable of making a

proper use of the various appliances, and of keeping them in perfect order.

The future possibilities of this agent in the treatment of pulmonary diseases seems to me to be very great. Judging from the results which have been obtained in the treatment of other morbid conditions, there is good ground for believing that a galvanic current, in the form of electrolysis, may, some time in the future, prove the best means of attack upon a tuberculous process in the lungs. Some recent experiments of Apostoli show that the influence of the positive pole of the galvanic current is a powerful germicide in its action, even such vigorous microbes as the bacillus anthrasis being destroyed by a very short exposure. No experiments have as yet been made with the bacillus tuberculosis, but I have work of this sort in progress in my laboratory, the results of which I hope to be able to report upon at an early date.

A building for a sanitarium in Colorado, one of whose great attractions is its sunshine, should be provided with glass-inclosed corridors or verandas, to afford opportunities for exercise in the sunshine without exposure to a low temperature during a cold spell.

Nearly all classes of patients suffering from pulmonary disease may be benefited by the proper employment of passive, or active-passive, muscular exercise. There is no class of patients in which massage, skilfully administered, secures more satisfactory results. A well-equipped sanitarium anywhere must include a department in which masso-therapy and manual as well as mechanical Swedish movements may be employed in a most skilful and thorough manner. I have found particularly useful in this class of cases various exercises and manipulations, by which the respiratory movements may be increased. In some classes of patients the application of the movements employed in artificial respiration, as by Sylvester's method, prove very serviceable. I have had in use for a number of years an apparatus run by steam, in which a patient sits while being put automatically through the movements of respiration. Masso-therapy and passive movements are also of great use to a patient suffering from pulmonary ailments, through its beneficial influence upon various other morbid conditions which are either coincident with or dependent upon the lung

infection. For example, Dr. Bouchard, in his "Leçons sur les Auto-Intoxications dans les Maladies," asserts that in two thirds of all the cases of phthisis, dilatation of the stomach is found as a co-existent condition. In my own observations I have found this condition present, and often accompanied by a condition termed by Glenard enteroptosis, in fully fifty per cent of the chronic cases. These cases are practicably incurable by any other means than masso-therapy, and without the aid of this valuable therapeutic means, it is extremely difficult and usually impossible to afford the patient relief from the great disturbance of nutrition occasioned by this condition of the stomach. The improvement of digestion in a phthisical patient will accomplish more in combating his disease than any other one thing, and certainly massage, especially directed to the stomach and bowels, will accomplish more in this direction than any remedy that can be administered internally.

Active exercises are not of less importance than passive exercises, and for this purpose a gymnasium is an indispensable feature of a sanitarium. A gymnasium does not consist simply of a large room with a few ropes and rings, dumb-bells, Indian clubs, horizontal bars, and jumping-boards. A gymnasium to be used by invalids need not be provided with apparatus for heavy gymnastic work. Indeed, I find it more prudent to exclude such appliances from the gymnasium almost altogether. Instead, it should be equipped with suitable apparatus for developing the muscular system in general, and the muscles of the respiratory apparatus in particular, by gentle and carefully graduated exercises. The gymnasium should be under the care of a director who is capable of carrying out to the letter the prescriptions made for each patient. To prescribe exercise intelligently, a physician must necessarily know something of the principles of physical culture, and must have some knowledge respecting the value and potency of each of the appliances for exercise at his command, as well as of the physiological action and proper dosage of the drugs which he administers. Exercise is a powerful therapeutic agent when properly employed, but it is probable that phthisical patients do themselves as much harm as good through its injudicious employment. The method which I have found most useful in employing exercise for invalids is as follows: Each patient is

submitted to a careful physical examination, which includes not only the usual examination of the heart and lungs, but examination to determine the condition and position of the abdominal viscera. Measurements of the chest and waist are taken, as well as comparative measurements of symmetry. The lung capacity and strength of expiratory and inspiratory movements are noted by means of the spirometer and the pneumatometer. The strength of each group of muscles in the body is then tested by a universal dynamometer which I have devised for this purpose, a description of which I will publish elsewhere. A careful prescription is then made for the patient, and he is set to work taking each day his daily dose of exercise, modified somewhat according to his changing physical states, as regularly and systematically as he does his daily meals. Certain kinds of exercises, as calisthenics, Indian clubs, wand exercises, breathing exercises, and the graceful Delsarte exercises, are taken in classes, accompanied with music. The benefits to be derived by exercise as a therapeutic agent, when thus restricted and symmetrically employed, need only to be seen to be appreciated. Once a month, or at more frequent intervals, the patient is tested by the dynamometer, and the results recorded. I have frequently seen patients nearly double their strength with three or four weeks' training of this sort, and in some instances the strength is more than doubled. The respiratory muscles of most phthisical patients are, when first examined, found to be greatly weakened. In some instances I have observed almost complete immobility of the chest, the patient depending upon the feeble diaphragmatic action to maintain respiration. By the combined use of massage, electricity, manual or mechanical aids to respiration, and carefully graduated exercises, the vigor of respiratory movements may be doubled within a very short time. Riding and walking classes may be usefully organized in connection with gymnastic work.

Special appliances for the treatment of pulmonary diseases must include the most approved means of employing medicaments by inhalation, as well as measures for the treatment of affections of the nose and pharynx. Apparatus for the employment of air under varying pressures is essential, together with apparatus for the preparation and use of oxygen and

other gases. These appliances are certainly not panaceas, but they are clearly most important and valuable accessories, and not only afford great relief to the patient, but delay the progress of disease, if they are not capable of arresting it altogether. The weak point in appliances of this sort is that their application cannot be made constant enough to produce a sufficiently powerful impression upon the affected tissues.

From the experiments I have made during the last ten years, I believe much can be accomplished by the employment of what might be termed "medicated atmospheres." I have seen great good result from placing the patient in a room furnished with appliances by which the entire air supplied to the room is impregnated with the medicament considered best adapted to the case. I have used creosote, chloride of ammonium, and various balsams in this manner, with more than ordinary results.

I believe also that much may be accomplished in pulmonary cases by the regulation of atmospheric conditions on a small scale. It is quite impossible to find a climate which is absolutely perfect, and which is the best adapted to pulmonary ailments at all seasons and at all times. Even the unsurpassed climate of Colorado must allow some imperfections. To meet this universal disadvantage, a sanitarium should be provided with certain apartments in which the atmospheric conditions can be controlled to a modified extent, and thus an artificial climate created. By this means the most important atmospheric conditions—warmth, heat, and moisture—can be very perfectly controlled. Air which is too dry can be moistened with the addition of steam, and air that is too moist can be dried by suitable means. It is even possible to appreciably increase or diminish the atmospheric pressure of an apartment at a very small cost, by means of exhaust or pressure fans. This I have never undertaken, but have found it entirely feasible to regulate to a nicety the temperature and hydroscopic conditions of the air, and apparently greatly to the advantage of such classes of patients.

Believing as I do in the contagiousness of tuberculosis, I consider of the greatest importance the employment of most thorough-going measures to prevent infection. It is my cus-

tom to require every patient suffering from this disease to collect all the sputa in paper receptacles, which are burned, so as to insure absolute disinfection of all microbes. I believe it possible for much mischief to be done by bringing together a considerable number of tuberculous patients without taking precautions of this sort. In localities in which complete immunity from this disease was once enjoyed, tuberculosis has become indigenous through importation of the bacilli by tuberculous patients. It is not to be supposed that the constantly changing air of such localities has become infected, or that either the soil or the water is the habitat of the mischievous bacillus. The hiding-places of the microbes are to be found in the hotels and boarding-houses, in carpets filled with the dust of dried sputum, and in upholstered furniture in which such dust has lodged. In a thousand ways places in which no restrictions are placed upon tuberculous patients, and no pains taken to destroy the microbes by disinfection, may become the source of danger to the well.

The dietetic department of a sanitarium is by no means of small importance. One of the greatest inconveniences experienced by invalids availing themselves of climatic changes, is the difficulty in securing suitable food properly prepared. The average hotel or boarding-house cook knows nothing of dietetics or of the chemistry of cooking. A sanitarium must provide food prepared in such a manner as to be both wholesome and palatable, tempting to the patient whose appetite is perverted and fickle, and at the same time easy of digestion and highly nourishing. The only cook who can accmplish this is one who has been specially trained for the purpose. Bad eating, and the consequent impaired digestion, undoubtedly lays the foundation for many cases of pulmonary disease, and hence a careful regulation of the dietary, with the provision of suitable food for the invalid, is one of the things which certainly should be found in a well-regulated sanitarium.

In meeting the demands of invalids, it is often necessary that special food preparations should be provided. The reality of the demand of this sort is shown in the sale at the present time of peptones, peptonoids, and prepared foods of every description, which has grown to be an immense and doubtless, to the manufacturers, a very profitable business. The profit

to the consumer is by no means commensurate. Peptones and peptonoids, and the various preparations from beef blood and butchers' remnants, really possess, as has been shown by Bouchard, Dujardin-Beaumetz, and others, very small nutritive value, while they contain a very considerable amount of undesirable material, in the shape of leucomaines and not infrequently ptomaines, some of which, in any but the smallest doses, are highly poisonous. Notwithstanding their small value, most of these food preparations are sold at a price which would furnish an individual enough nourishment for an ordinary meal, only at the cost of several dollars. The foods which are best adapted to the individual and which are of greatest utility and the highest nutritive value, can be manufactured at small expense, and it is almost indispensable that a large establishment for invalids should be provided with the facilities for the manufacture of such special food preparations as may be needed. Every patient has his diet prescription, and must be required to follow it implicitly. In cases requiring it *lavage* and *gavage* should be skilfully employed. There are no therapeutic means which are followed by more brilliant results in suitable cases than these.

A complete medical establishment, such as a sanitarium should be, should be furnished with every possible means for diagnosis. In addition to the ordinary appliances for physical examination, the cardiograph, the pneumograph, the pneograph, the sphygmograph, the chronometer, electrometers, and other means for electrical measurements, facilities for bacteriological work, and whatever else will aid in the study of disease, must be in readiness for use. I hardly see how a sanitarium can be successfully conducted without a laboratory well equipped for carrying on chemical, physiological, and biological work. Within a month of the present moment I have been forcibly impressed with the value of bacteriological examinations. It is my custom to examine the sputa for the bacillus tuberculosis in every case of suspected phthisis. A few weeks ago a patient from the Pacific coast came to me for treatment for chronic nasal and pharyngeal catarrh. A slight cough led me to make a physical examination of the lungs. I was able to discover nothing abnormal, although I made a careful exploration of all portions of the lungs, particularly of the apices. A

subsequent examination of the sputum showed bacilli tuberculosis present in considerable numbers. After repeated subsequent examinations, I was able to determine slight physical signs of mischief in the apex of the right lung. Since that time the symptoms have become more marked, and at the present time there is unmistakable evidence of a tuberculous deposit in the right lung. I am quite certain that without a bacteriological examination I should not have made a correct diagnosis of the case. I advised my patient to become a resident of Colorado, with the expectation of remaining there, and I trust the superior climatic conditions which he will find here will restore him to health.

A sanitarium affords the best possible advantages for physiological and pathological research. The facilities which are provided for therapeutic use can be largely made valuable for carrying on experimental researches of a varied character. By the aid of the methods of the physiological laboratory morbid conditions can be most accurately studied, the progress of disease can be observed with precision, and the influence of remedies can be noted with facility.

Meteorology, in relation to health and disease, one of the newest lines of medical research, ought to receive a liberal share of attention in connection with this line of work, and hence a sanitarium should afford proper facilities for it. Fifteen years of experience in meteorological observations, as well as the study of the results of the extensive researches carried on by the State Board of Health of Michigan, have convinced me of the great importance of this line of study, and the valuable results which in time will be yielded by exact and persevering work in this line.

Every sanitarium should be provided with a well-equipped and aseptic surgical ward, for the proper care of cases requiring surgical treatment.

Facilities for recreation must also be provided, although I must speak against the introduction of exciting amusements. The individual who is in earnest about getting well will go about the matter in a business-like way, and if all that is possible is done for him, and every possible facility afforded him, he will have enough to keep him busy the greater part of his waking hours. I am quite opposed to the encouragement

of games of chance, other than such simple games as croquet, lawn-tennis, etc., which afford exercise as well as diversion. Card-playing, chess, and billiards, I think, ought not to be encouraged. My objection is based upon the ground that the patient can spend his time more profitably, as regards health, in some other manner. In a sanitarium with nearly four hundred inmates, of which I have charge, games of this sort are not prohibited, yet patients very rarely engage in them. My plan is to keep every patient so busily engaged in profitable health-gaining employment that he has no time for anything which will do him the least harm.

Provision for the poorer class must not be forgotten in the organization of a large sanitarium. Said the Great Teacher to His disciples, "The poor ye have always with you." Every person who has ever had extensive experience in sanitarium work is prepared to appreciate the full force of this statement. The managers of a sanitarium hear constantly upon their doors the knockings of the worthy indigent invalid begging admittance. A sanitarium organized upon the broad plan which I have outlined, and undertaking to do for the invalid all that modern medical science can do, should be organized upon so firm a financial basis, and administered in so liberal a spirit, as to make generous provision for the worthy poor; and while the latter may not be provided with the same luxuries as are the wealthier class, they may be furnished, at very moderate cost, or to a limited extent gratuitously, with the most skilful medical advice and treatment. An economical plan for the accommodation of this class would be the caring for of an agricultural and dairy ranch in connection with the institution, located at a distance not too great to be accessible by an hour's ride, and affording constant communication by telephone. At such a place patients could be given free grounds for pitching tents, which could be furnished at small rental, and in many instances could be furnished employment sufficient to pay the actual cost of table board. In this way expenses could be reduced to a minimum, and thus the poor could receive benefits of which they would be deprived if compelled to pay the same price as the rich. Of course in such a scheme it would be necessary to provide the in-door accommodations for the poor during inclement weather, or it might not be possible to

carry on this branch of the institution excepting during the warmer months of the year.

Finally, one thing more is eminently necessary for the successful establishment of a sanitarium in Colorado—viz., a well-trained and organized corps of physicians, nurses, attendants, cooks, and other employés. Indeed, this is the most essential part of an institution of this sort. The lack of trained and experienced workers has doubtless been the chief cause of failure in a large proportion of the hundreds of sanitarium enterprises which have been started in various parts of the country, and which after a few months of painful experience ignominiously collapsed. A constant educational work must be carried on to supply substitutes for those who drop out of the institution, and to provide for the growth of the institution.

I think it safe to predict that there is a great future before institutions organized on the sanitarium plan, which will work in scientific and professional lines, so as to command the respect of the profession, and which will keep abreast of the advanced line of progress in the development of rational medicine. Thousands of cases which after years of drifting about among physicians are given up as incurable may be restored to health by a few months of "health training" in a well-conducted sanitarium. The necessity for the treatment of certain classes of individuals in properly managed institutions is coming to be generally recognized, and the need of institutions of this sort is each year appreciated more by those who pursue the practice of medicine, with a constant purpose to secure for their patients the best possible results in the shortest possible time.

DISCUSSION.

AFTER the reading of Dr. Kellogg's paper, Dr. Rogers announced the particulars of an excursion into the mountains, by the members of the Society and their friends, which was discussed at some length.

The following discussion took place on Dr. Kellogg's paper :

Dr. Bowditch : I should only like to add my appreciation of Dr. Kellogg's admirable paper. There is one thing that occurs to me in regard to the establishment of a sanitarium for consumptives ; in fact, the objection has occasionally been brought up that it is not a good plan to put so many consumptives together on account of the possible contagion and depressing effect.

As far as the latter is concerned, I think it would amount to practically nothing, or very little. I questioned a lady last summer, who had been at a sanitarium in Germany two years, and she said, " The first two weeks I had a slight depression, but after that I thought of nothing except this delightful place, and I should be sorry to leave it." She was gradually improving, with a prospect of recovery.

When at Dr. Trudeau's Sanitarium in the Adirondacks, I asked him about the advisability of putting so many invalids together. He asked me to listen. I looked at the other end of the piazza, and a lot of patients were singing and laughing together, and he remarked that that was their condition the whole time, so the objection amounts to practically nothing.

Dr. Kellogg spoke also of establishments for the poorer classes. I have spoken of this at previous meetings, and I regard it as of the greatest importance. There are also classes who cannot go to Colorado, which is, so far as we know now, *the* climate of America for certain cases ; and I should like to say again that I think a great deal more can be done, as our good friend, Dr. Kretzschmar, of Brooklyn, has said so urgently, in the immediate vicinity of our own cities, where the climate is not so salubrious.

I am connected with the building of a sanitarium at Sharon, Mass., near Boston, that is now well on its road to completion, which is intended solely for people of a class who cannot afford to go far away from home, but where, I am convinced from experience, we can do very much more than we have been able to do in Boston. I hope, in the course of our meetings in the future, to be able to tell you something of the results accomplished there, although we do not hope to accomplish what we could in a similar climate to this. I feel, as I said before, that a great deal more can be done by properly established sanitariums near our great cities.

Dr. Solly: I was very much interested in Dr. Kellogg's paper, and I fully agree with what he says. There is no man more competent to speak of these things, because he has carried them out practically. I have not had the pleasure yet of paying a visit to his sanitarium, but I know of many who have, and they all endorse its high character. If the doctor builds a sanitarium in Colorado, I hope it will be in Colorado Springs.

Every case is not suited for a sanitarium ; some undoubtedly do better at home. The greater number of consumptives, however, would, I believe, improve more surely and rapidly in a sanitarium. The results of the cases I have just reported to you would, I think, have been yet more favorable if a majority of the patients had been treated in such an institution as Dr. Kellogg has described. That these matters are carried to too great an extent, and too much fuss made over little details, is doubtless often true.

As the doctor says, the name of sanitarium has been misused, and is often applied to a place where a number of invalids are simply herded together, without any proper curative measures being applied to them. In fact, the real word we ought to use is "hospital"—a hospital in its proper sense. There is no patient that dislikes to go into a hospital more than a consumptive ; and they object to being labelled as consumptives ; they say their lungs are not affected, they have only bronchitis, etc.; and this is so, because consumption is still looked upon as a necessarily fatal disease by the laity. I myself was labelled a consumptive twenty-six years ago, but I am still here, and hope to continue for some time.

Dr. Kellogg: I would be very glad to know how the profes-

sion in Colorado feel with regard to the establishment of a sanitarium here, as I see quite a number of the gentlemen of the profession here. I have come to the State—this is the second time—to look about a little with reference to the establishment of a branch institution. We are sending away from our institution every fall to Colorado and adjoining States enough people to fill a moderate sized sanitarium, because of their climatic advantages, although we endeavor to do as much as possible for them by means of artificial climates. We still have quite a contingent of consumptive patients that we keep at home and care for that cannot be induced to go so far away on account of the lack of suitable advantages for the care of invalids in these dry Western States. I think, as Dr. Bowditch does, that a good deal can be done for these patients in their home climate, but of course sanitarium and climatic advantages combined will do more for them than either can do alone.

I have felt somewhat doubtful about the propriety of establishing a sanitarium in a climate specially advantageous for consumptives. I have thought, in the first place, it might not be a financial success. The local physicians might consider it not in the interest of the profession. Perhaps the patient would consider that the advantages are all out-doors and free for everybody, and so consider it not necessary to attach himself to an institution ; and so a good many things are to be thought of.

The institution we propose to establish in this State, if we start one, will be largely a philanthropic one. The dividends will be assigned by the stockholders for the purpose of improving the facilities, and in the support of a charity department, as we have been doing for the last twenty years at an institution at Battle Creek. We spend fifteen or twenty thousand dollars a year in the treatment of the sick poor, and our work in this line is increasing. If we establish an institution in this State, it will be on the same basis, and will be a non-dividend institution ; a stock company, but on the plan of a self-supporting charitable institution—the profits received from the wealthy to be used in caring for the worthy sick poor. In the first ten or twelve years, the profits must be largely used in increasing the facilities ; but some charity work will

be done from the first. Personally, should not care to be connected with any other kind of an institution. Our work at Battle Creek is on that basis, and if we have anything to do with an institution in this State, it will be on the same basis. The only compensation expected, so far as I am concerned, will be in the satisfaction of contributing to the advancement of rational medicine and the benefit derived by the patients. Unless we can organize an institution here in the interest of the profession, and in harmony with them, we don't care to come.

I am glad to have the opportunity of placing the matter before the profession of this State, so that the character of the proposed institution may be understood.

Dr. Denison: We are very much obliged to Dr. Kellogg for presenting his subject so plainly, and we trust, if he will decide to come here, his institution will be a great success.

Personally, I have expressed my opinion in my introductory remarks yesterday, and I take no exception to what has been said, unless it is, as it seems to me, that more importance should be given to building such a sanitarium in Colorado, on the cottage plan, rather than in one central institution.

THE THERMAL SPRINGS OF SALT LAKE CITY.

By Dr. George W. Foster, of Salt Lake City.

The subject of natural mineral waters has in former years engaged the attention of this Association, and efforts have been made to determine with more exactness the therapeutic value of these waters as they occur in the United States. In the line of this inquiry, by courtesy of your president, I am enabled to offer the following brief contribution in relation to the thermal springs in and near Salt Lake City.

In this instance, as in similar cases, difficulties are encountered at the outset in lack of suitable accommodations and appliances at the springs, and of competent medical supervision and clinical study. What I have to offer is derived from limited personal observation, the statements of other physicians in the city, and of patients who have used the waters; supplemented by deductions from the known constituents of the springs, and the use of similar waters from other springs whose effects have been more accurately observed. Along the western base of the Wasatch Mountains, which surround Salt Lake City on the east and north, these springs break from the ground at intervals for an extent of several miles. Two only of these have been utilized by the erection of baths, and these of the most primitive sort, consisting simply of buildings enclosing apartments containing tubs and "plunges." The Warm Springs are within the city limits and are accessible by electric car-line. They have a temperature of 103° F. Beck's Hot Springs are about three miles from the centre of the city, accessible by two railroads, a 'bus-line, and prospective electric railway. Their temperature is about 130° F. Considerable quantities of free carbonic acid and sulphydric acid are contained and given off from the water.

The flow from Beck's Hot Springs is about six hundred gallons per minute. Another spring (not utilized) a half mile to the south of Beck's and nearer the city yields a similar

flow, while the Warm Springs, owned by the city, flow about two hundred gallons per minute. The water from the various hot springs forms a lake estimated at about one hundred acres in extent, whose overflow is into the Jordan River, ultimately contributing to the saline constituents of Great Salt Lake. Analyses of these springs are as follows :

CONSTITUENTS.	Beck's Hot Springs.	Warm Springs.
	Grains per Gallon.	*Grains per Gallon*
Chloride of Sodium	.95506	.77248
Chloride of Magnesium	.4334	.01588
Carbonate of Magnesium	.....	.03412
Chloride of Calcium	.06957	.....
Sulphate of Calcium	.01907	.13668
Carbonate of Calcium	.03001	.03321
Chloride of Potassium	.03761	.03388
Silica	.00315	.00212
Organic matter	Trace.	.....
Iron	Trace.	.....
Total	1.25871	1.02845

Considerable quantities of hydrosulphuric acid and carbonic acid gases are contained and given off by the waters.

These analyses are doubtless merely proximate, as regards the particular constituents as they exist in the waters, and it is a question in chemistry, which I have not had an opportunity of verifying, whether or not in the presence of free sulphydric acid the bases would be found united with it, to some extent, in form of sulphides. Estimated by the law that each degree of temperature in excess of that of the soil represents a depth of source amounting to about fifty-five feet, the depth of source of the hot springs would be about five thousand feet.

Under this great pressure the gases are held in solution or possibly unstable union with bases and freely discharged in large bubbles as the surface is reached. Whether or not under changes of temperature and pressure such chemical changes occur as to give to any elements or compounds increased activity from the "nascent state," I will not attempt to discuss ; mere speculations would be of no practical value, as compared with clinical facts. The chief solid constituents of the springs are the chlorides of sodium, potassium, magnesium, and calcium, the carbonates of magnesium and cal-

cium, a small amount of silica, and calcium sulphate. The waters are very soft, soap not being required even in the washing of clothes ; whether due to the presence of gliadin or other element not mentioned in the analyses, I am not able to state. Taken internally the water is, as its composition indicates, mildly laxative, in doses of from two to six or eight glasses daily, which quantity is usually taken by those using the baths.

The springs are mostly used by those suffering from rheumatic and other chronic affections of the joints, scaly cutaneous eruptions, lead poisoning, boils, abscesses, scrofulous ulcers, and catarrhal affections. In rheumatism their value is attested by physicians and still more strongly by the laity ; and lack of accommodation only appears to stand in the way of their use by large numbers of the victims of this disease. In chronic eczema of the scaly form the scales are readily removed, and patients have expressed themselves as greatly benefited by their use. Data are meagre upon this point, however. Lead poisoning is relieved by the action of the hydrosulphuric acid upon the metal, as it is eliminated by the skin and mucous membrane of the alimentary canal, converting it into the insoluble sulphide and thus preventing its reabsorption. Other methods of treatment, as by potassium iodide and magnesium sulphate, may be more rapid and efficacious in some cases. That sufferers from mercurial poisoning, syphilitics, or other cachexias would be benefited by these waters combined with suitable tonic treatment seems to be probable, from the experiments of Dr. L. Blanc at Aix-les-Bains, upon patients under treatment by the sulphurous waters of those springs.

By the solvent power of hyposulphite and sulphite of sodium formed in the blood from sulphur, in presence of alkaline salts and oxygen, albuminate of mercury is dissolved and eliminated by the urine. In two fifths of the cases where mercury had not been taken for one, two, or three months, it was found in the urine after the thermal sulphur treatment, its absence having been demonstrated before the treatment was begun, indicating that it had accumulated in the body and was thus eliminated. The Salt Lake springs have been found to be particularly efficacious in the treatment of boils, ulcers,

and abscesses attended with unhealthy pus formation. This accords with the recommendation of Ringer in the first edition of his "Therapeutics" of the use of the sulphides in these affections, and the experience of many others since.

Gastric and intestinal catarrhs are also benefited by similar waters and inferentially by these. Without going to any extent into the question of absorption by the skin, it may be mentioned as an accepted fact that hydrosulphuric acid is absorbed by the lungs and alimentary canal, and is an agent of some potency for good or ill in the economy, demanding in its use the circumspection usually employed in the use of active drugs, and deserving special study. Perhaps enough has already been said to indicate to those interested in thermal mineral springs the comparative value of those at Salt Lake City.

It is probably true of these, as of all other thermal springs, that their value is not because of their mineral constituents solely or even chiefly, but by reason of the system of hydrotherapeutics established upon them, combining with the depurative action of their internal use the potent agencies of baths, douches, and massage with skilful gradation or alternation of temperature, and without which they are unscientific and unpractical. The climatic and hygienic surroundings, the recreations of the place, the regulation of diet and of habits, the unreserved yielding to treatment and pursuit of health, the faith and hope inspired by occult qualities supplied by the imagination, are also well-recognized factors of the various water cures. They are *cure*-factors which can probably be so well combined in no other way, and a well-organized sanitarium of this sort is a boon alike to patient and physician.

With the admirable climate and delightful surroundings of Salt Lake City, the unique attractions of the Lake, the growing wealth and importance of the city, and the undisputed advantages of ample volume and temperature, it cannot be doubted that suitable improvements will soon be made at these springs, greatly enhancing their advantages. As the water is in abundance and fully heated in nature's caldrons for all possible therapeutic uses, even if it were of double-distilled purity, beyond that of Poland or Bethesda, there are here afforded all desirable elements of an attractive and effective health resort.

TREATMENT OF PULMONARY CONSUMPTION BY RESIDENCE IN COLORADO AS EXEMPLIFIED BY THE ANALYSIS OF 141 CASES.

By S. Edwin Solly, M.D., M.R.C.S., England; of Colorado Springs.

Last summer, while in London, I had a conversation with Dr. Theodore Williams. He referred to his report of 141 cases of phthisis treated in the Alps. For the purpose of comparison, I decided to take the same number of cases in presenting my report to you of those treated in Colorado. Dr. Williams has carried his cases up to the time of making his report, and thus some of the later cases have been too short a time under observation to make them of value as regards the general results, and naturally tend to make them more favorable than they might have been had he allowed two years to have elapsed, as I have done, between his last case and his report.

I have taken my cases as they happened to come, only selecting them in so far as I rejected those in which the notes were not sufficiently complete, or concerning whose present condition or death I could not procure reliable information. They are not arranged in the order of the date of their first examination, but were added to the table as the final information concerning them was procured. As soon as the required number, 141, was obtained, my report of cases stopped. They are scattered through my practice during the first fourteen years my residence in Colorado, and thus, without giving the entire results of my experience of the treatment of phthisis during that period, give a very fair sample of it.

Dr. Solly then spoke of the chief points of his paper and statistics and their comparison with those of others, quoting some cases in illustration, and then proceeded:

I have taken the number 141 as the limit of my report of cases, in order to make the comparison as exact as possible

with the 141 cases reported on by Dr. Theodore Williams, of London, in May, 1888, which were all treated, with the exception of four, in Alpine resorts. All the cases which I report were treated in Colorado Springs, though in a few instances, a portion of the period of residence was spent in other parts of Colorado or in New Mexico, in similar climates and high elevations. In many there were absences of a month or more at a time during convalescence which have not been deducted. The cases were all under my observation and treatment more or less continuously during the periods covered by the histories herewith outlined. They have been selected only so far as I took those whose history, from the time of the first visit to the present, was sufficiently complete to make them thoroughly authentic. As many have left Colorado and are widely scattered, it was only possible to gain reliable information concerning their present condition of a portion of those treated. When a case was thus complete it was added to the list without regard to the order of date, and when the desired number of 141 was reached the reports were closed. The period over which the observations extend is the past sixteen years, the time of my residence in Colorado Springs. No cases are reported on whose first visit dates more recently than two years ago, thus allowing time to confirm the reports, and in most of them the first visits were paid at much longer distances of time. Although these reports do not give a continuous record of my observation of cases during the past sixteen years, yet taken as they are at random with respect to results, I believe them to represent very fairly my experience during that period. The comparison with the reports of Dr. Denison* and of Dr. Fisk,† both of Denver, as well as with those of Dr. Williams, show so close a resemblance in percentages and results as to confirm this belief. I have followed Dr. Williams' methods of classification and statistics very closely, as I believe they are as good as can be used, and have only varied from them in a few instances, and have not followed him in his analysis of local results through lack of time. In the tables of cases I have limited myself, as

* Rocky Mountain Health Resorts. By Charles Denison, M.D. Houghton, Mifflin & Co.

† President's Address to Colorado State Society, 1888. By Dr. Samuel Fisk.

far as possible, to practical conclusions, not the reasons for reaching them, which the original notes alone would show. I have also omitted many of the minor points, so as to make the tables less complicated for reference. The headings under which the cases will be found in the tables appended to this paper are the same as Dr. Williams'—viz., sex, age, date of first visit,* length of illness previous to commencing residence, family predisposition, hæmoptysis, length of residence. Then, under the general heading of result, are placed general result, weight, local result, chest circumference, and lastly notes, under the heading general result. The results are grouped under five terms—cured, greatly improved, improved, worse, died. Those cases which were pronounced cured were those in which all symptoms, both local and general, had disappeared, and who were, at or near the time of making the report, still in good health. Of these several had returned to their homes, and in all intervals of from two to fifteen years had elapsed since the cure. The greatly improved are those who were apparently perfectly recovered except for some remaining evidence of past disease in the lungs, or slight partial disability in general health. The improved are those in whom the disease was in a state of arrest, in whom the tendency toward death was apparently averted, in whom there might have been some advance of disease since coming, and in whom there were still some local or general evidence of disease, but of whom it was fair to say that they were improved by their residence in Colorado. The number grouped under the heading worse are few, as in most cases the time that had elapsed had allowed for their termination in death. Under the head of died are put those who died either in Colorado or elsewhere from the disease ; two cases who improved died later, one of syphilis and one of rheumatic endocarditis, are therefore not recorded under this heading.

Sex.—The patients were 106 males and 35 females, belonging to all conditions of life, though none in actual want or pov-

* Nature and extent of disease on commencing residence in Colorado, which was usually nearly the same date as first visit. Where the first visit was not paid till some time after residence was commenced, I have, where possible to obtain the information, given the condition on first commencing residence under the head of first visit.

erty. Dr. Williams's were all of the wealthier classes only. Their *ages* at the time of commencing high altitude treatment are shown in Table I. The average age for males was 30.7 years; females, 23.

TABLE I. SHOWING AGES OF 141 PATIENTS WHEN THEY BEGAN TO RESIDE IN COLORADO.

	Males.		Females.		Total.	
	No.	Percentage.	No.	Percentage.	No.	Percentage.
10 to 20 years	8	7.54	4	11.42	12	8.51
20 " 30 "	53	50.00	16	45.71	69	48.20
30 " 40 "	34	32.07	14	40.00	48	34.00
40 " 50 "	11	10.37	1	2 85	12	8.51
Total	106	....	35	...	141	..

The greatest number were between 20 and 30 years of age, being 48.2 per cent. Dr. Williams's were 56.02 per cent; Dr. Fisk's, 53 per cent; Dr. Denison's, 47.2. Between 30 and 40 there were 14 per cent more than in Dr. Williams's cases, and Drs. Denison's and Fisk's were also more. As in Dr. Williams's, and most statistics, the percentage of females attacked before 20 years of age was higher than the males, and reversed between 20 and 30. Between 30 and 40 the percentage of females was higher again in my tables, while lower in Dr. Williams's.

The average age for males was 30.7, as against 27.27 (Williams), and females, 23, against 24.46 (Williams), showing that in Colorado the men were generally older and the women younger than in the Alps.

Date of first visit.—This was usually within a week or so of arrival.

Length of illness.—This is the period that elapsed between the first symptoms appearing and the patient's arrival in Colorado, which was in most but not all cases near the time of first visit.

Between 1 and 6 months	20	Ill less than one year, 52.
" 6 months and 1 year	32	
" 1 and 2 years	44	The average length of illness was for both sexes 2 years 8. 6 months, nearly 2¾ years before coming.
" 2 " 3 "	17	
" 3 " 4 "	8	
" 4 " 5 "	6	
" 5 " 15 "	14	

The average length of illness for males was 32.04 months; for females, 23.91 months. This shows the average of cases were much more advanced when coming to Colorado than when going to the Alps, as the averages given by Dr. Williams are 24 months for males and 19.31 months for females. Dr. Denison's average for both sexes was 22 months—that is, three quarters of a year less than mine.

Family predisposition was found in 82 (62 males and 20 females), being present, therefore, in 58.1 per cent of the 141 patients, as against 44 per cent only of Dr. Williams's cases. Dr. Denison shows 51 per cent; Dr. Fisk, 52 per cent; mine showing 56.6 per cent in males and 57.14 per cent in females, with Dr. Williams's 32 per cent in males and 73 per cent in females. Both these show the stronger influence of heredity among females, as pointed out by Williams. In my total number of hereditary cases 70.73 per cent improved; in Dr. Fisk's, 73 per cent improved.

This shows, in both Dr. Fisk's and my own, a little higher percentage of improvement among hereditary than among non-hereditary cases, which is perhaps explained by the earlier resort to treatment by climate and the greater care afterward. The belief among most of the laity that consumption is necessarily hereditary has undoubtedly led many of the non-hereditary cases to be slower to take care of themselves.

Hæmoptysis occurred to a greater or less extent in 78 cases, being 55.31 per cent. Seventeen had a recurrence after coming to Colorado, being 12.76 per cent of the whole 141, or 21.79 per cent of the 78 cases. Of the 78 cases, 20 were cured, 17 greatly improved, 13 improved, making 50 benefited, being of the 78 cases 64.1 per cent benefited. Twenty-six died and 2 deteriorated, making 28 worse, or of the 78 33.3 per cent deteriorated. The total per cent of cases with hæmoptysis, 55.31 per cent, is close to Dr. Williams's average for 1000 cases, which was 57 per cent. In the 141 cases he recently reported the average was only 43.76 per cent.

Pyrexia was found in the afternoons of the first week of arrival to a greater or less extent in 80 cases, 56.73 per cent of the 141. Of these 40 per cent got worse, which is above the average of worse for the whole 141, that being 32.62 per cent. Dr. Williams refers to only 10 of his cases having fever about

the time of the first visit. That his examinations were made, I presume, at sea-level, and mine at 6000 feet elevation, soon after a fatiguing journey up to it, may account in part for the difference, and the rest perhaps may be explained by the more advanced character of most of my cases.

History and nature of cases.—Five had pigeon breast, 2 syphilis, 3 heart displaced, 3 marked dilatation, besides several in which there were symptoms of an undecided or transient dilatation, 1 old mitral regurgitation, 1 asthma, 20 cases of tuberculosis, besides pulmonary—viz., 3 anal fistulæ, 2 hip disease, 2 aural disease, 2 testicle disease, 2 kidney (lardaceous) disease, 2 cervical glandular disease, 7 laryngeal (unmistakably tuberculous), and besides these 13 had marked symptoms of laryngeal congestion, with more or less aphonia, which in several suspiciously suggested early tubercular deposit.

Of the 7 undoubted cases of tubercular laryngitis, 2 im-

TABLE II.

Stage.	Number.	Per cent.	State of Lungs before Residence in Colorado.	Cured.	G. Improved.	Improved.	Worse.	Death.	Total.
1st	62	43.97	25 had right lung alone affected.....	13	7	.3	..	2	25
			21 had left lung alone affected.....	15	3	..	..	3	21
			16 had both lungs affected	8	4	1	1	2	16
				36	14	4	1	7	62
2d and 3d	79	56.02	30 had right lung alone in 2d and 3d stages	8	6	6	1	9	30
			5 had right lung in 2d and 3d stages and the left in 1st stage	..	1	..	..	4	5
			28 had left lung alone in 2d and 3d stages	2	5	8	..	13	28
			9 had left lung in 2d and 3d and right in 1st stage.....	..	2	1	..	6	9
			7 had both lungs in 2d and 3d stages.	1	..	1	1	4	7
			Totals.....	47	28	20	3	43	141

Stage.	Number.	Per cent.	State of Lungs in 2d and 3d Stages, Separate.	Cured.	G. Improved.	Improved.	Worse.	Death.	Total.
3d	30	21.27	13 had the right lung alone affected.	1	3	3	..	6	13
			14 had the left lung alone affected...	..	5	1	..	8	14
			3 had both lungs affected.....	..	..	1	..	2	3
				1	8	5	..	16	30
2d	49	34.75	22 had the right lung alone affected.	7	4	3	1	7	22
			22 had the left lung alone affected...	2	2	8	..	10	22
			5 had both lungs affected.....	1	..	..	1	3	5
				10	6	11	2	20	49

proved and 5 died, giving improved, 28.57 per cent. Of the 13 dubious and the simple chronic laryngeal cases, the improved were 61.53 per cent. Of the 7 tuberculous, in all but 1 there was more or less improvement and healing of ulcers for a time at the first, and in some the ulcers remained healed till the last few weeks.

State of the lungs.—Table II., which precedes, gives the principal facts. Of the 141 patients, 43.97 per cent were in the first stage, or that of tuberculization, and 56.02 per cent in the second and third stages, or those of softening and excavation (of these 34.75 per cent were in the second and 21.27 per cent in the third stage). Dr. Williams's 141 cases show more in the first stage—viz., 64½ per cent, and in the second and third combined, 35½ per cent.

In 23 of the 141 patients both lungs were affected—*i.e.*, 16.3 per cent.

In 118, or 83.68 per cent, one lung was attacked—the right in 60, or 42.55 per cent, and the left in 58, or 41.13 per cent. One lung was affected in 83.68 per cent; in Dr. Williams's, 62 per cent. The right in 42.55 per cent; Williams's, 35½ per cent. The left in 41.13 per cent; Williams's, 27 per cent. Both lungs were affected in 16.3 per cent; Williams's, 37½ per cent—a very much higher percentage. In the first stage one lung was affected in 74.35 as against Williams's ⅝ in ¾ months, Both lungs in 25.8, or a fourth; Williams's in one third. The right was alone attacked in 25 and the left in 21, as against 37 and 23, both confirming Dr. Williams's previous conclusion that the right lung is the most liable to tuberculosis.

Of the 62 cases in the first stage 16 had signs of tuberculization at only one apex, all of whom improved. While 17 had signs limited to both apices, of these all improved but 3; one of the 3 would apparently have recovered had he not left for home before being cured.

Dr. Williams says that 17 of his cases had only apical lesions; whether these include those in which both apices were affected he does not explain. In the rest of the 62 cases of the first stage—viz., 46, the tuberculization was more or less extensive, in many very much so.—Of the 79 cases of softening and excavation 49 were in the second stage, softening, and 30 in the third stage, having cavities already formed. As

most of the serious cases were for long periods under close observation, I believe the diagnosis of the cavities was generally correctly verified or refuted, and therefore the distinction is approximately correct—viz., that there were 30 with distinct cavities on arrival. Dr. Williams speaks of 42 cases of excavation out of his 50 "where, as a rule, this process was already accomplished;" probably if those in the process of forming had been separated the number with distinct cavities would have been nearer the same number as I report.

Of my 30 cases with cavities, 27 had one lung alone affected —13 right and 14 left. Dr. Williams reports 28 with excavation of one lung, nearly the same; he also shows the greater tendency of the left to excavate, stating that the right lung was in the second and third stages in 19 and the left in 30. My cases show this also, but in a less degree—35 right and 37 left. Both lungs were in second and third stages in 7 cases of mine, while Williams reports 1 case. He also writes that his cases show a cavity with limitation of disease to a single lung in the proportion of 28 to 22, while mine show 58 to 22.

RESULTS.

FIRST STAGE.

62 cases.	Cured	36=58.04 per cent.	Improved, 54=87.09 per cent.
	G. Improved	14=22.93 "	
	Improved	4= 6.45 "	
	Worse	1= 1.61 "	Worse, 8=12.90 per cent.
	Death	7=11.29 "	

SECOND AND THIRD STAGES.

79 cases.	Cured	11=13.92 per cent.	Improved, 41=51.89 per cent.
	G. Improved	14=17.72 "	
	Improved	16=20.25 "	
	Worse	2= 2.53 "	Worse, 38=48.10 per cent.
	Death	36=45.56 "	

TOTALS.

141 cases.	Cured	47=33.33 per cent.	Improved, 95=67.37 per cent.
	G. Improved	28=12.76 "	
	Improved	20=14.11 "	
	Worse	3= 2.12 "	Worse, 46=32.62 per cent.
	Death	43=34.96 "	

Tubercle bacilli in the sputum.—It has been my custom for the past two and a half years to have each case examined for them, but as these reports are of cases almost all before that period, no report on this point can be made at this time.

Medicine and diet.—None of the specific forms of treatment,

such as creosote, etc., have been found encouraging to use. Tonics, malt and cod liver oil and hypophosphites have been used more or less, though the need for them has generally been less obvious here than at home ; alcohol in different forms in moderation only. Great relief and no apparent injury has been obtained from antipyretics where the fever was distressing, and for troublesome cough, much expectoration and laryngeal and bronchial complications, the use of the Globe inhaler with various drugs, notably benzoin, I have found of much benefit. Symptoms and complications generally have been treated where interfering with the general improvement. Massage and modified gymnastics have been used, the regulation of rest and exercise being urged, but with difficulty carried out. The diet has been as closely attended to as possible, and in the graver cases frequent feeding and milk and raw eggs were used. Milk was used with benefit by most of the patients. Horseback exercise was found one of the best for many.

Length of residence.—Here it is very difficult to give any figures that, as regards their bearing on results, might not be misleading, and especially so in a comparison with the length of residence in Alpine resorts, chiefly because so many invalids come and make their permanent residence in Colorado, as they often find opportunities to engage in work or business and a pleasant residential society. Then again, as there is no falling or melting snow period, as in the Alps, patients often stay both winter and summer in Colorado until well. It is, therefore, true that the length of residence is usually greater in Colorado than in the Alps, but whether a result is reached in a longer or shorter time on an average it is impossible to say.

The question of leaving or remaining in Colorado is an interesting one. Of the 141 patients, 59—*i.e.*, 41.84 per cent—left Colorado. Of these, 45—*i.e.*, 61.44 per cent—are to-day in the improved class, as they were on leaving, while 38.31 per cent were worse on leaving, or became so since. Of the 59 who left, 33 had been or were in the first stage ; 26 in the second and third. Of the 82 who remained, 58.15 per cent of the whole, 82.76 per cent are in the improved class, while only 17.24 per cent are in the worse. This indicates that several of those who went away might have been improved by a

longer or a permanent residence. On the other hand, of those who remained and improved there are undoubtedly several who are well enough to leave, 19 being pronounced cured, and from my knowledge of their condition I believe it is fair to assume that about 50 per cent of the total number coming to Colorado can return to their homes to live with safety, providing, of course, the danger is only climatic. The percentage of improvement and number who could have returned permanently to their homes would have been very much higher had several more exercised forbearance in delaying their return until their disease was more decidedly arrested. I am firmly of the belief cases cured in elevated countries have at least as good a chance of keeping well after returning home as those cured at sea-level, and owing to the decided increase of general and pulmonary vitality imparted by the climate, probably a much better one. I am sorry I am unable, at the present time, to give such further analyses of my cases as Dr. Williams and Dr. Denison have done, especially as regards local results, but must proceed to close with a review of the gross results.

Gross results.—I find that, dividing my general results into two broad classes of those who were improved after a residence in Colorado and those who were made worse, as is done by Dr. Fisk, that there were 67.3 per cent improved and 32.62 per cent worse, which corresponds with his figures, showing that improvement is to be expected in two out of every three consumptives coming to Colorado. Dr. Denison's statistics show a little better than this, giving only 28 per cent worse. I think, however, if the subsequent histories had been traced as closely as mine, probably the percentage of worse would have shown nearer the full one third that Dr. Fisk's and mine exhibit. Turning to Dr. Williams's report, however, we find his gross results much better—74.82 per cent more or less improved and only 21½ per cent deteriorated, thus indicating that three out of four improved in the Alps, while only two out of three improved in Colorado. However, when we allow for *difference of material* we find the results very similar. In the Alpine cases (Williams) 64½ per cent were in the first stage, whereas in the Colorado cases (Solly) there were only 43.97 per cent. Also, as regards *complications*, they were more and graver in the Colorado than in the Alpine,

there being 20 cases which reached Colorado with evidence of tuberculosis elsewhere besides in the pulmonary tissues, 7 being cases of laryngeal tuberculosis and one with advanced lardaceous kidney disease. With regard to *length of illness* prior to coming to the altitude : of the Colorado cases, the average length for males was 32.04 months ; Alpine, 24.0 ; females, 23.91 months ; Alpine, 19 31 months. The Colorado cases show 52 of the 141 only whose illness was under one year, while there were 82 patients of this class who went to the Alps. *The difference between English and American invalids* doubtless explains why the cases should arrive in Colorado in worse and more advanced condition than in the Alps, as shown by comparing Drs. Denison's, Fisk's, and my own with Dr. Williams's cases. The American male, more than the female, will neglect the first warnings of disease and continue his necessary occupation or unnecessary worship of mammon long after his physician has warned him to flee to the mountains, and when he ultimately goes his disease has reached a further stage, and he has used up his reserve force. Once an enforced exile and invalid, being unaccustomed to loaf, he frets under leisure and applies himself too vigorously to recreation or a study of his symptoms, or else, missing his accustomed round, sinks into apathy. His temperament, which is usually nervous, makes all this more trying for him, and renders him also a bad judge of what amount of exercise he should take, etc. While he has had little training in submitting to dictation, he will not subject himself to rules laid down by his physician, and will rarely use them unless alarmed, often unreasonably, at some turn in his disease. The class of English from whom Dr. Williams's patients are drawn, on the other hand, are persons who usually seek advice early, follow it when taken, and by long practice find loafing easy, their phlegmatic temperament and habits of looking up to some one above them making them more docile as patients and less easily alarmed. The conclusion is a just one, I believe, that, other things being equal, there is a close resemblance between the results of treatment of phthisis in the Alps and Colorado. It is probable that early cases of apical first stage, occurring in persons without a marked tuberculous diathesis or heredity, would do equally well in either. Where a prolonged residence either

on account of advanced disease, diathesis or heredity is desirable, or the necessity of remunerative occupation exists, Colorado would be preferable. In the Alps there is less wind and dust, in Colorado more dryness and sunshine. If now Dr. Williams's tables are combined with Drs. Denison's, Fisk's, and my own, we get the results of high altitude treatment in about 600 cases, and can show improvement in something better than two out of three, which, as Dr. Williams and others have shown, far exceeds any other percentage of improvement put forward—as, for instance, Dr. Dettweiler's 1022 cases show improvement in only about one quarter, although in his closed sanitarium the elements of preventable deterioration by carelessness and ignorance, which undoubtedly influence unfavorably the results of the open sanitaria, are eliminated.

	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of illness before coming to Col.	Family predisposition.	Hæmoptysis.	Length of residence.
1	H. B.	M.	32	1875, Sept. 17.	Both. Third stage; left upper, large cavity. Second right, upper consolidation; chronic laryngitis; no fever or night sweats. General condition fair.	5 years.	None.	Slight at first, severe later; none since coming.	Off and on 10 years.
2	C. H.	M.	32	Oct. 5.	Both. Third, large cavity, upper right; small cavity, left upper. Illness began acutely, March, 1871; fever; night sweats; very weak.	1½ yrs.	Father and mother, 2 sisters; 3 in infancy; 1 delicate.	Frequent and profuse at all stages; severe since coming.	18 years, with a few months' absence
3	C. M.	M.	33	1876, April 22.	Both. Second stage; right upper, complete consolidation, slight left apex. Bronchitis; slight fever; marked malaise; nervous.	1 year.	Mother.	Frequent, but slight; some since.	12 years, with absences.
4	L. B.	M.	4	1876, Nov. 18.	One. Third; left lower, small cavity, pleuritic adhesions; heart drawn over to right; diarrhœa; no fever or night sweats; fair condition.	1 year.	None.	None.	11 years, with absences.
5	A. S.	M.	31	1877, Oct. 19.	Both. Second, right upper; second left apex; bronchitis, fever, night sweats; poor digestion and physique very weak.	10 yrs.	None.	Severe in all stages; some since.	5 years.
6	H. W.	M.	31	1877, Oct. 6.	One. Second, right upper; tuberculous testicle; no fever or night sweats; fair condition.	5 years.	1 brother.	None.	13 yrs.
7	R. C.	F.	34	1878, June 3.	Both. Third, right apex; first left apex; fever; night sweats; poor digestion; very weak.	4 mos.	3 sisters.	None.	4½ months.
8	H. S.	M.	24	1878, Aug. 28.	Both. First, both apices; fever; weak.	2 years.	Father.	None.	12 yrs.
9	F. H.	M.	21	1878, Oct. 10.	One. First, left apex; slight fever and slightly weak.	15 mos.	Father.	None.	13 yrs.
10	M. B.	M.	32	1878, Nov. 8.	One. Second, right upper half; bronchitis; no fever or night sweats; fair condition.	6 years.	1 sister.	Several slight; none since.	3 years.
11	H. S.	F.	18	1878, Oct. 8.	One. First, right lower; no fever or sweats; dyspeptic; general malaise.	6 mos.	2 aunts, 1 uncle.	None.	8 mos.
12	D. S.	M.	26	1878, Nov. 13.	One. First, left upper; tubercular laryngitis; fever, night sweats, acute onset; weak, dyspeptic.	8 mos.	M. grandmother, 1 sister.	None.	6 mos.
13	G. G.	M.	21	1879, May 24.	One. First, right, middle and lower; heart drawn over to right; began with pneumonia; no fever; fair strength.	3 years.	None.	None.	10 mos.
14	W. B.	F.	16	1879, June 24.	Both. Third, both apices; diarrhœa; fever; sweats; very weak.	1 year.	Mother, 1 aunt.,	Several slight; none since	6 weeks.
15	A. P.	M.	24	1879, Dec. 15.	Both. First, both apices; no fever; general condition fair.	2 mos.	None.	None.	6½ months.
16	J. G.	M.	32	1879, Dec. 16.	One. Second, left lower; fever; sweats; weak; emaciated.	6 mos.	None.	Slight; none since.	7 years.
17	D. P.	M.	25	1878, July 2.	One. First, right upper; fever; sweats; very weak; acute onset, with hæmoptysis.	6 mos.	Mother.	Several slight; few since.	12 yrs.
18	C. D.	M.	32	1879, July 30.	Both. First, both apices; ankylosed hip; slight fever; fair condition.	8 mos.	Mother.	Several severe; none since	4 years.
19	H. W.	F.	36	1879, Sept. 4.	One. Second, left upper; cardiac dilatation; melancholia; no fever; weak; bronchitis.	10 yrs.	2 sisters, 1 brother.	Several slight; none since.	12 yrs.
20	S. W	F.	40	1878, July 23.	Both. Third, both upper; asthma.	3 yrs.	None.	None.	12 yrs.

General Result.	Weight.	Local result.	Chest circumference.	Notes.
Greatly improved.	Slight increase.	Contraction of cavity and clearing of right lung.	Increase.	Remained in Colorado during winters; went East in summers for ten years. Has been living and well in East last five years.
Cure.	20 lbs.	Cavities cicatrized; vesicular murmur clear and vigorous everywhere.	Much increase.	Has continued active in office business in Denver and Colorado Springs past nine years. Has lived East six months without harm.
Greatly improved.	Increase.	Fibrosis of right; clearing of left.	Increase.	Remained two years without change; then went East in summers last ten years of residence; lived East last two years well.
Death.	Less.	Cavity quiet till last year; fibrosis through left lung; heart disease developed.	Increase.	Was able to do a great deal of work; never strong; frequently changed climate last three years.
Death.	Gain and then loss.	Cavity formed in right upper; left cleared; then acute bronchitis left.	Increase.	After passing through stage of excavation, got into fair condition, though always delicate; carried off by acute bronchitis, which came on few weeks before death.
Worse.	Less.	Cavity in right upper, with general fibrosis of right; consolidation of left apex.	First increase, then loss.	Is in poor condition, weak and thin; drives about; has been about the same for last year. Short summer trips East.
Death.	Less.	Tuberculosis spread through right and some in left.	Increase.	Slight improvement first month. Then much fever.
Cure.	Gain.	At first extension, then clearing.	Increase.	Remained at first four months nearly well. Went back East, got ill again. Tried Florida, Georgia and South California, March, 1883. Returned to live, here now.
Cure.	Gain.	Cleared up entirely in few months.	Increase.	Remarkably strong; lives here, but spends long intervals away without harm.
Cure.	Gain.	Clearing.	Increase.	Resumed business as traveller; keeps well in the East.
Cure.	Gain.	Complete clearing.	Increase.	Lives East; married since; healthy; children well.
Death.	Less.	Extension in both lungs; breaking down.	Less.	Laryngeal ulcers healed at first under treatment; ulceration returned in last month.
Cure.	Gain.	Cleared up entirely.	Increase.	Returned home; seen recently, well.
Death.	Less.	Rapid softening.	Nil.	Temporary revival of strength.
Death.	Gain.	Lungs cleared; went home; remained well one year; then rapid softening and death.	Increase.	When he returned home, pronounced well, and appeared so for a year; then second attack fatal.
Improved.	Less.	Fibroid contraction.	Nil.	Got strong; worked hard on ranch; no chest symptoms; lived here; took rheumatic fever, and died in seven years of cardiac mitral disease.
Cure.	Gain.	Complete clearing up.	Increase.	Lives an active life in Colorado; married; very robust.
Cure.	Gain.	Complete clearing up.	Increase.	Living and strong in New England; heard of three years ago.
Improved	Less.	Fibrosis, left upper cardiac compensation. Bronchiectasis.	Increase.	Has dyspnœa and much expectoration on exertion; seems fairly strong; gets about; remains the same; lives here.
Improved.	Gain.	Fibrosis; bronchiectasis.	Increase.	Has dyspnœa on exertion; gets about; remains much the same; no asthma; lives here.

No.	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of Illness before coming to Col.	Family Predisposition.	Hæmoptysis.	Length of Residence.
21	E. H.	M.	18	1880, Feb. 2.	One. First, right upper; no fever; pale and weak.	16 mos.	None.	None.	1½ yrs.
22	W. B.	M.	23	1880, May 10.	One. First, right apex; no fever; fair strength; strumous cervical glands.	1 year.	Father strumous, 2 brothers.	Slight; none since.	10 yrs.
23	J. A.	M.	32	1880, Nov. 18.	One. Third, left upper; medium cavity; chronic laryngitis; no fever; fair condition.	1½ yrs.	None.	None.	1 year.
24	F. S.	M.	28	1880, —— 19.	One. Second, left upper; cavity forming; fever; night sweats; fair strength and condition.	7 years.	None.	Frequent, severe; several since.	6 years.
25	S. F.	M.	24	1880, —— 22.	One. First, left upper; no fever; fair condition; onset acute.	8 mos.	None.	None.	10 yrs.
26	T. S.	M.	19	1880, —— 24.	Both. First, both apices; most left; slight fever; no sweats; rather weak.	8 mos.	Father.	Slight at beginning; none since.	10 yrs.
27	E. W.	F.	24	1881, Jan. 7.	One. Second, right upper; slight fever; no sweats; weak; dyspeptic.	3½ yrs.	None.	None.	9½ yrs.
28	W. N.	M.	35	1881, April 2.	One. Third, right upper and second lower lobe; fever; night sweats; fair strength.	8 years.	Father.	Several profuse; none since.	9 years.
29	H. W.	M.	30	1881, July 22.	One. First, left upper; slight fever; weak; had recently got worse.	14 yrs.	Very marked.	Several slight; none since.	10 yrs.
30	H. G.	M.	25	1881, July 27.	One. Second, left lower lobe; consolidation left apex; fever; night sweats; weak.	6 mos.	Mother, G. M. aunt, 1 brother.	Several severe; slight since.	9 years.
31	F. G.	M.	21	1881, July 27.	Both. Second, at both apices and left base; fever; sweats; weak.	2 years.	Mother, G. M. 1 aunt, 1 brother.	Several severe; none since.	6 mos.
32	T. M.	M.	34	1881, July 30.	One. First, left upper; fever; night sweats; weak.	15 yrs.	None.	Slight; none since.	9 years.
33	A. K.	M.	22	1881, Dec. 27.	One. Second, right upper; bronchitis; no fever; fair condition.	3½ mos.	1 brother.	Few slight; none since.	3 years.
34	F. H.	M.	20	1882, Jan. 25.	One. First, left upper; fever; sweats; weak.	10 mos.	None.	Slight; none since.	5 mos.
35	C. T.	F.	34	1879. Oct. 29.	One. Second, right upper; fever; sweats; weak.	6 mos.	None.	None.	1 year.
36	G. H.	F.	21	Feb. 27.	One. First, left apex; fever; sweats; weak; anæmic.	1½ yrs.	2 sisters, 1 brother.	None.	3 years.
37	G. R.	M.	26	April 18.	Both. Third, both apices; fever; sweats; weak; albuminuria.	14 mos.	Father strumous, 1 brother hydrocephalus.	None.	2 mos.
38	J. B.	F.	37	July 1.	Both. Third, right upper; small cavity; second left apex; fever; sweats; weak; chronic laryngitis; aphonia.	5 years.	2 half brothers.	None.	8 years.
39	G. M.	M.	41	May 8.	Both. Second, right upper; first left apex; no fever or sweats; fair strength.	2 years.	Mother.		3 years.
40	F. F.	M.	27	—— 9.	One. Third, right upper; large cavity; fever; sweats; very weak.	1 year.	2 aunts, 1 uncle.	Slight; none since.	3 years.

General Result.	Weight.	Local Result.	Chest Circumference.	Notes.
Cure.	Gain.	Complete clearing up.	Increase.	Returned East to college; well and robust; married last year.
Cure.	Gain, 15 lbs.	Complete clearing; glands shrunk after iodoform treatment.	Increase.	In vigorous health; lives here; spends half year (summer) in East.
Death.	Gain.	Condition somewhat improved till last few days; then tubercular meningitis.	Increase.	Improved greatly; had bronchitis; improved again; then meningitis and death.
Death.	Less.	Large cavity formed in left upper lobe; then stationary till last two months, when extension.	Increase.	Improved very much after excavation ceased; active in business; lived in Colorado; sudden death from hæmoptysis.
Cure.	Gain.	Cleared up entirely.	Increase.	Lives in Colorado; active in business; vigorous; goes East at all seasons.
Cure.	Gain.	Cleared up entirely.	Increase.	Very robust; lives on ranch; spends summers East.
Greatly improved.	Gain.	Fibrosis.	Increase.	General health and vigor fair; lives here; goes East occasionally in summer.
Greatly improved.	Gain.	Contraction of cavity; fibrosis.	Increase.	General health and vigor very fair; active in business; spends time in this State and New Mexico.
Cure.	Gain.	Cleared up.	Increase.	Active in business; vigorous; lives here; goes East summers.
Improved.	Gain.	Moderate cavity formed in left lower lobe; now contracted; consolidation at left apex cleared; consolidation at right apex then clearing.	Increase.	Has evidently a tuberculous kidney and testicle; still slight albuminuria; lives here and in New Mexico; is in very fair health.
Death.	Less.	Breaking down of left lung after slight arrest in first few months.	Nil.	Left here and died 1½ years later in Los Angeles.
Cure.	Gain.	Cleared up.	Increase.	Is strong and healthy; actively employed in Denver; East occasionally.
Death.	Less.	At first signs almost disappeared; then acute pneumonia, right base; then cavity.	Less.	Was apparently nearly well, when, after foolish exposure, took pneumonia; died in England eight months later.
Death.	Less.	Apparent clearing up of lung; then tubercular meningitis.	Increase.	Seemed doing well; getting strong till two days before death from tubercular meningitis.
Cure.	Gain.	Begun clearing at once; examination two years after leaving showed complete clearing.	Increase.	Slight signs, but was strong and vigorous when returned home; since quite well.
Cure.	Gain.	Lung cleared entirely.	Increase.	Got quite strong; returned home to coast; had healthy child; very well.
Death.	Less.	Breaking down and extension.	Nil.	Had lardaceous renal disease; was careless, caught cold; died of uræmia.
Greatly improved.	Gain.	Fibroid contraction around cavity; left cleared.	Increase.	Larynx had superficial ulceration and suspicious swelling, but healed; is vigorous; lives here; East summers.
Greatly improved.	Gain.	Fibrosis right; left cleared.	Increase.	Got strong and continues so; living and working in the East.
Death.	Less.	Extension of cavity, and extension to left apex.	Nil.	Local condition remained stationary, but general health improved till he went home, and returned here to die, one year later.

No.	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of Illness before coming to Col.	Family Predisposition.	Hæmoptysis.	Length of Residence.
41	C. M.	M.	49	1882, Aug. 1.	Both. Second stage; left upper lobe, fibrosis; right apex consolidated; tubercular laryngitis; no fever; general health fair.	½ yrs.	None.	None.	1 year.
42	C. S.	M.	20	Oct. 4.	One. Second, left upper; no fever; fair condition.	4 years.	None.	Slight; none since.	20 mos.
43	L. D.	M.	28	Nov. 10.	Both. Second, both uppers; fever; sweats; weak, pigeon chest.	2½ years	None.	None.	2½ years.
44	J. I.	M.	18	Nov. 13.	One. First, left upper; slight fever; no sweats; rather weak.	1⅓ yrs.	Father.	None.	1½ years.
45	F. W.	M.	29	Nov. 27.	One. First, right lower; no fever; general health fair.	11 mos.	None.	None.	8 years.
46	E. K.	.	26	Jan. 4.	Both. Second, both apices; fever and sweats; anæmic; slight physique; weak.	4 years.	None.	Slight; none since.	8½ years.
47	J. Y.	M.	37	Dec. 15.	One. First, left upper; no fever or night sweats; fair condition.	6 mos.	Father, sister.	Several slight; none since.	1⅓ years.
48	B. A.	M.	42	Dec. 22.	One. First, right middle; slight fever; night sweats; weak; bronchitis.	14 years	None.	Several slight; slight since.	8 years.
49	E. A.	F.	16	1884, Nov. 12.	One. First, right apex; no fever; fair condition.	7 mos.	Pat. G. F., 1 brother.	None.	6 mos.
50	E. W.	M.	39	1886, Aug. 9.	Both. Second, left upper; first right apex; chronic laryngitis; no fever; moderate strength.	5 mos.	None.	None.	10 mos.
51	T. F.	M.	26	1884, April 4.	One. First, left apex; no fever; good condition.	6 mos.	None.	Several slight; none since.	6 mos.
52	T. H.	M.	39	1887, July 6.	Both. First, both apices; slight fever; no sweats; good condition.	8 mos.	None.	Slight; none since.	5 mos.
53	R. B.	M.	31	July 14.	Both. Third, right upper and middle and left apex; fever; sweats; very weak; dyspepsia.	6 years.	1 brother.	Several slight; none since.	2 mos.
54	S. S.	M.	29	1875, Jan. 6.	One. Second, right middle; no fever; good condition.	10 years	1 aunt, 1 brother.	None.	15 years.
55	W. M.	M.	26	1886, May 3.	Both. First, both apices; no fever; fair condition.	1½ years	1 aunt, 1 sister.	None.	1 year.
56	G. H.	M.	32	1885, July 21.	Both. Third, right upper; small cavity at left apex; fever; night sweats; weak.	2 years.	None.	Several slight; none since.	13 mos.
57	W. W.	M.	37	1887, Dec. 11.	Both. First, both apices; no fever; dyspepsia; poor condition.	2 years	Mother.	None.	7 mos.
58	L. H.	M.	21	1885, May 27.	Both. First, both apices; no fever; old mitral regurgitation murmur; poor condition.	4 mos.	Father, mother, 2 sisters.	None.	1 year.
59	H. T.	M.	37	1887, Dec. 19.	One. Third, right apex (large cavity); no fever; fair condition.	12 years	2 sisters.	Few slight; none since.	4½ mos.
60	H. P.	M.	24	1883, June 1.	Both. First, left apex and extreme base and first right apex; slight fever; fair condition.	20 mos.	Grandmother, 2 sisters.	Several slight; none since.	1 year.

General Result.	Weight.	Local Result	Chest Circumference.	Notes.
Death.	Slight loss.	On leaving for home, right lung clear, left stationary; throat healed, with tissues thickened.	Slight increase.	Had good voice and general vigor; fibroid lung the same; went back to work in East; died two years later.
Death.	Less.	Breaking down left, extension to right. Otorrhœa.	Increase.	Improvement both local and general first fourteen months; rapid decline last six months. Died here.
Death.	Less.	Cavity formed in left, and breaking down began in right.	Less.	Remained here at first 1½ years; marked improvement; some clearing; went East; returned worse; died one year later.
Cure.	Gain, 20 lbs.	Complete clearing up.	5 inches expansion.	Returned home to England; living there, well.
Greatly improved.	Less.	Fibrosis.	Increase.	Lives here; goes East in summer; able to work; no symptoms; keeps thin.
Worse.	Less.	Cavities formed at both apices; pneumonic consolidation at right base.	Less.	Did well up to two years ago, when went to live on mountain ranch; poor food and hard work developed a mitral systolic bruit, and excavation took place; returned here to Sanitarium; slight improvement.
Cure.	Increase.	Cleared up entirely.	Increase.	Returned home East; living and working; well.
Improved.	Increase.	There was a moderate increase of area of consolidation; since stationary.	Increase.	The tuberculosis appears to be arrested; the general health is lately improved, but attacks of gouty bronchitis occur; lives here; goes away for a month or so in summer.
Cured.	Increase.	Cleared up.	Increase.	Got very strong and well; returned to England; heard of 1½ years ago.
Greatly improved.	Increase.	Fibrosis left; right cleared; voice improved.	Increase.	Returned to business East in a year; was well a year ago.
Cured.	Increase.	Cleared up entirely.	Increase.	Returned East; well; at office work.
Greatly improved.	Increase.	Some consolidation left, when went East.	Increase.	Returned East; is at work, and apparently well.
Death.	Decrease.	Breaking down progressed steadily; death by heart failure.	Nil.	No rallying; steady decline.
Cured.	Decrease.	Cleared up entirely.	Increase.	Had an attack of croupous pneumonia same lung; now living here, well and active; frequent visits East.
Greatly improved.	Increase.	Was clearing when moved to other part of Colorado.	Increase.	Returned to Canada; practising physician; reported himself well eighteen months ago.
Death.	Loss.	Slow but steady breaking down.	Nil.	No pause in progress downward.
Improved.	Increase.	Fibrosis, with partial clearing.	Increase.	Returned East to office work; reported as holding his cure, but not well.
Cure.	Increase.	Lungs cleared, heart the same.	Increase.	Returned East to office work, strong; reported well two years ago.
Improved.	Increase.	When left, cavity quiet; seemed contracting.	Increase.	Returned to England; general health much more vigorous; heard of this year as doing fairly.
Cure.	Gain.	Cleared up entirely.	Gain.	Returned East to work; in city for last five years; keeps well.

No.	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of Illness before coming to Col.	Family Predisposition.	Hæmoptysis.	Length of Residence.
61	G. W.	F.	30	1883, July 2.	One. First, left apex; no fever; poor condition; anæmic	2 years.	Mother, 2 uncles.	None.	7 years.
62	A. W.	F.	35	1883, Aug. 28.	One. First, right upper half of lobe; fever and night sweats; fair strength.	2 years.	Father.	None.	1 year.
63	J. O.	F.	29	1883, Dec. 17.	One. First, right upper; no fever; weak, dyspeptic.	8 mos.	Mother.	None.	8 mos.
64	F. M.	F.	32	1883, Dec. 18.	One. Second, left upper (cavity forming); bronchitis; slight fever; condition fair.	2 years.	4 uncles, 2 sisters and 1 brother.	None.	5 years.
65	R. T.	M.	35	1884, Feb. 24.	One. First, right upper; first, middle and lower lobes; slight fever and night sweats; weak.	1 year.	Mother.	Several slight; none since.	3 years.
66	J. R.	M.	28	1884, Feb. 17.	One. First, left apex; history of first affection being in right apex; no fever; weak, nervous exhaustion.	1½ yrs.	None.	Several slight; none since.	2 years.
67	F. N.	F.	28	1884, May 10.	One. Second, right upper; bronchitis at base; fever; night sweats; weak.	2 years.	None.	None.	2 years.
68	B. H.	F.	31	1884, May 26.	One. Third, left upper; slight fever and sweats; weak; small cavity.	6 mos.	None.	Slight; none since.	1 year.
69	A. F.	M.	33	1884, Sept. 15.	One. First, right apex; bronchitis below; chronic pharyngitis; no fever; fair condition.	1 year.	Grandmother and 1 aunt.	None.	8 mos.
70	G. C.	M.	23	1884, Oct. 31.	One. Second, right apex; bronchitis; fever; night sweats; weak.	8 mos.	None.	None.	1½ years.
71	H. W.	F.	40	1884, Nov. 1.	Both. First, both apices; pleurisy, left lower; no fever; weak.	9 mos.	None.	None.	6 years.
72	S. M.	M.	24	1884, Nov. 18.	Both. Third, left upper (contracted cavity); second right apex; no fever; general health fair.	5 years.	Grandmother and 1 aunt.	None.	6 years.
73	W. F.	M.	37	1884, Nov. 20.	Both. First, both apices; no fever; neurasthenia; moderate strength.	20 mos.	None.	Several severe; some since.	6 years.
74	J. H.	M.	46	1884, Nov. 28.	One. First, left upper; no fever; neuralgia; fair condition.	3 years.	None.	Several severe; none since.	6 years.
75	C. L.	F.	32	1885, June 8.	One. First, right apex; no fever; chronic laryngitis; dyspeptic; weak.	2 years.	1 uncle and several cousins.	None.	1 year.
76	M. H.	M.	46	1885, Nov. 6.	One. Second, fibroid consolidation right middle lobe; fever; night sweats; moderate condition.	3 years.	1 uncle, father bronchial.	None.	5 years.
77	R. J.	M.	18	1885, Dec. 29.	One. First, left apex; fever; sweats; nervous; weak.	3 years.	7 uncles and aunts.	Several slight; none since.	5 years.
78	W. P.	M.	36	1885, Dec. 8.	Both. Second, right upper; left apex; no fever; fair condition.	4 years.	2 first cousins.	None.	5 years.
79	B. S.	F.	32	1885, April 10.	One. First, left apex; slight fever; chronic laryngitis; fair condition.	6 mos.	None.	Slight; none since.	2 years.
80	R. B.	M.	32½	1885, May 28.	Both. First, right apex and left upper; bronchitis.	18 mos.	Mother.	Slight; none since.	2 years.

General Result.	Weight.	Local Result.	Chest Circumference.	Notes.
Greatly improved.	Gain.	Fibrosis.	Gain.	Has lived mostly since in Colorado, going East for two or three months at time; in business in Denver last four years.
Cure.	Same.	Cleared up.	Gain.	Returned East; examined three years ago; quite well.
Cure.	Increase.	Cleared up.	Gain.	Returned East, well.
Improved.	Less.	Dry cavity; less bronchitis.	Gain.	Returned home fairly; not able to do much.
Greatly improved.	Gain.	Fibrosis of right upper; clearing of middle and lower lobes.	Gain.	Returned East; heard of two years ago as well.
Cure.	Gain.	Cleared up entirely; neurasthenia disappeared.	Gain.	Returned East; is well and at work; strong.
Improved.	Gain.	Cleared up partially.	Gain.	Returned East; is not strong, but no chest symptoms.
Greatly improved.	Loss.	Fibrosis; cavity contracted.	Gain.	Returned East; fair health year ago.
Cure.	Gain.	Cleared up.	Gain.	Returned to New England; well and at work.
Cure.	Gain.	Cleared up.	Gain.	Went and lived in Kansas; well until death from accident, one year ago.
Cure.	Gain.	Cleared up.	Gain.	Lives here, active and well; no symptoms for three years.
Greatly improved.	Less.	Cavity quiet; right cleared.	Gain much.	At beginning of attack went to Davos, where disease arrested; came and settled here; gained in strength and local condition.
Worse.	Less.	Breaking down at both apices, then fibrosis.	Nil.	Lives here; slowly losing.
Much improved.	Gain.	Partial clearing; some fibrosis.	Increase.	Lives here; goes East winter and summer; active and strong.
Greatly improved.	Gain.	Partial clearing up.	Increase.	Returned to New England; fair health.
Cure.	Gain.	Cleared up.	Increase.	Lives here; hearty; active in business.
Greatly improved.	Gain.	Some extension, then partial clearing.	Increase.	Lives East; no lung symptoms. Had slight heart strain; neurotic; fair strength.
Improved.	Gain.	Partial clearing.	Increase.	Lives here; engaged in business; fair general health.
Cure.	Gain.	Clearing up.	Increase.	Lives in Europe; here recently on visit; keeps well.
Cure.	Gain.	Clearing up.	Increase.	Returned to England well last year.

No	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of Illness before coming to Col.	Family Predisposition.	Hæmoptysis.	Length of Residence.
81	A. A.	F.	21	1883, July 3.	One lung. Second stage, left lung, upper lobe; bronchitis; fever; night sweats; weak.	7 years.	None.	None.	3 years.
82	G. D.	M.	53	1885, March 31.	Both. Second, lower; fever; weak.	2 years.	None.	None.	2 years.
83	L. E.	M.	37	1885, Dec. 21.	One. Second, right base; no fever; condition fair.	7 years.	Father.	Slight; none since.	4½ yrs.
84	E. P.	F.	25	1885, Dec. 17.	One. Second, right middle and lower; slight fever and sweats; bacilli; fair strength.	1½ yrs.	None.	Slight; none since.	6 mos.
85	A. R.	M.	36	Nov. 14.	Both. Third, right base, small cavity; first stage, both apices; no fever; fair strength.	4 years.	Sister.	Several severe; none since.	5 years.
86	C. W.	M.	60	1886, Dec. 3.	Both. First, right middle and upper; left, small patch of consolidation at angle of scapula; bronchitis; chronic laryngitis; no fever; weak.	3 years.	2 mat. aunts.	Slight; none since.	4 years.
87	H. S.	M.	30	Jan. 4.	One. First, left apex; fever; night sweats; weak.	1 year.	1 uncle.	None.	6 mos.
88	J. E.	M.	46	Feb. 11.	One. Second, left lower; slight fever and sweats; nasal catarrh and fair condition.	1 year.	1 uncle and 1 aunt.	Slight; none since.	4 years.
89	R. R.	F.	25	1885, March 10.	Both. Third, left lower. small cavity; first at both apices; no fever; good condition.	7 years.	None.	Several severe; few moderate since.	5 years.
90	J. A.	M.	46	1886, May 3.	One. First, right upper and middle; chronic laryngitis; had acute pneumonia two years ago; fever and night sweats; weak.	2 years.	None.	None.	2 years.
91	T. W.	M.	26	July 1.	Both. Third, left upper, contracting cavity; first, right apex; some bronchitis; very nervous; no fever; very weak.	3 years.	None.	Slight; none since.	3 years.
92	K. McC.	F.	27	July 7.	Both. Second, right apex and left base; no fever; very weak.	3 years.	None.	None.	4 years.
93	J. T.	M.	40	July 27.	One. First, right base; old scar at left apex quiescent; no fever; weak.	3 mos.	None.	Slight; none since.	10 mos.
94	R. M.	M.	33	Oct. 14.	One. Second, left apex; chronic laryngitis; fever; night sweats; rather weak.	1 year.	Pat. G. father.	None.	4 years.
95	W. E.	M.	36	Oct. 19.	Both. First, right upper and left base; bronchitis; no fever; very nervous; rheumatic; fair condition.	20 mos.	Father, mother, 1 aunt, 2 uncles, 4 brothers.	Several severe; none since.	1 year.
96	C. O.	M.	27	Nov. 11.	One. First, right apex; first, right base; no fever; fair condition.	3 years.	Father, mother, 3 uncles, pat. G. P.	Several slight; 1 since.	1 year.
97	L. H.	M.	29	Dec. 15.	Both. First, right upper and left apex; no fever; condition fair.	1½ yrs.	None.	Several slight; none since.	2½ yrs.
98	A. J.	M.	30	Dec. 19.	Both. First, both apices; fever; night sweats; chronic laryngitis; bacilli; weak.	1 year.	Pat. G. father, 1 aunt.	Several slight; none since.	4 years.
99	E. H.	M.	21	1887, March 1.	One. First, left apex; no fever; dyspepsia; bacilli; good condition.	2 years.	Mat. G. mother, father, sister.	None.	3½ yrs.
100	E. B.	M.	28	April 20.	One. First, left; no fever; condition good.	4 mos.	None.	Slight; none since.	1½ yrs.

General Result.	Weight.	Local Result.	Chest Circumference.	Notes.
Improved.	Gain.	Drying up and partial clearing.	Increase.	Returned to London; health still improving.
Cure.	Gain.	Cleared up in both lungs.	Increase.	Returned to live in New England; keeps well.
Greatly improved.	Gain.	Lung is clearing.	Increase.	Lives here; very active; goes East occasionally; general health good; examined few weeks ago.
Cure.	Gain.	Complete clearing up.	Increase.	Has been travelling chiefly since leaving here; perfectly well two months ago.
Improved.	Same.	Fibrosis at apices and around cavity.	Increase.	Lives in Colorado and does office work; fairly strong.
Improved.	Gain.	Left cleared entirely; partial clearing of right and fibroid contraction.	Increase.	Lives in New Mexico in similar climate; all active symptoms ceased; is working; fair health.
Cure.	Gain.	Complete clearing up.	Increase.	Returned East to work; here on visit last year; was well.
Cure.	Gain.	Complete clearing up.	Increase.	Resides here; works hard in office; goes East on visits; very well.
Greatly improved.	Gain.	Right cleared entirely; left upper partially; cavity contracted.	Increase.	Lives here; works hard; been East on visit; general health very fair.
Cure.	Gain.	Cleared up.	Increase.	Returned East to work; well four months ago.
Greatly improved.	Gain.	Right cleared entirely; left cavity contracted; bronchitis disappeared.	Increase.	Living in Europe; kept well till acute pneumonia last winter; his physician reported he had made entire recovery from it.
Cure.	Gain.	Cleared up entirely.	Increase.	Lives here; married; one healthy child; keeps well.
Cure.	Gain.	Cleared up entirely.	Increase.	Returned East to office work; well last year.
Improved.	Same.	Consolidation partly cleared; laryngitis cured.	Increase.	Lives here; works hard; goes East in summer; would be quite well, probably, if not overworking.
Greatly improved.	Less.	Paid two visits here; much improved in first six months; clearing up; second visit less so.	Increase.	Went back East; got worse; returned second time; some improvement, which continued in California, where he now is comparatively well.
Much improved.	Gain.	Lung began to clear up; then caught cold, causing some extension at right apex, but was clearing up again when he left.	Increase.	Returned to England and continued to improve; seen there four months ago; apparently well.
Cure.	Gain.	Both sides cleared up entirely.	Increase.	Returned East to office work; continues well.
Much improved.	Less.	Some extension at first; now has fibrosis; no cough or other symptoms.	Increase.	Lives here; is in fair condition, but has naturally poor physique.
Cure.	Gain.	Cleared up.	Increase.	Lives here; naturally poor physique, but now looks strong and hearty.
Cure.	Same.	At first extension; then cleared up.	Increase.	Returned East; heard of recently as well.

No.	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of Illness before coming to Col.	Family Predisposition.	Hæmoptysis.	Length of Residence.
101	H. L.	M.	40	1887, July 27.	One. Second, left upper; fever; weak; lumbago; very nervous.	2 years.	Paternal grandmother.	Slight; slight since.	3 years.
102	C. M.	M.	27	Aug. 13.	Both. Second, left upper and right apex; fever; rather weak; pigeon chest.	1 year.	None.	Slight; slight since.	3 years.
103	T. D.	M.	23	Aug. 28.	One. Second, left upper; no fever; general condition good.	3 years.	None.	Slight; none since.	3 years.
104	C. C.	M.	25	Aug. 25.	One. First, left upper; no fever; fair condition.	1 year.	2 uncles, father.	None.	3 years.
105	K. F.	M.	30	Sept. 16.	One. Second, left upper; slight fever; bronchitis; nasal stenosis; very nervous; condition fair.	1½ yrs.	None.	Several slight; some since.	3 years.
106	W. C.	M.	43	Oct. 22.	Both. Third, left upper, cavity; first, right upper; bronchitis; fever; night sweats; weak.	2½ yrs.	None.	None.	2 years.
107	E. L.	F	47	Nov. 7.	One. First, right upper; fever; night sweats; weak.	2 years.	2 mat. aunts, 1 sister.	Slight; none since.	3 years.
108	M. M.	F.	25	Dec. 15.	Both. First, both apices; no fever; anæmic.	3 mos.	Mat. G. M., pat. G. M., 2 aunts, 2 uncles.	None.	5 mos.
109	T. G.	M.	20	1888, Jan. 2.	Both. First, both apices; fever; night sweats; condition moderate.	6 mos.	None.	Slight; none since.	6 mos.
110	L. M.	M.	24	Jan. 24.	One. First, right upper; no fever: tubercular laryngitis; weak.	3 years.	Mother, 2 mat. aunts.	None.	2½ years.
111	F. W.	M.	22	Feb. 26.	Both. First, both apices; fever; night sweats; anæmia.	2 mos.	Father, pat. G. F., 1 aunt, 1 brother.	Several slight; none since.	2½ years.
112	A. T.	M.	40	June 6.	Both. Third, right upper, cavity; second, left upper; fever; night sweats; weak.	4 years.	1 aunt, 1 brother, 1 sister.	Several slight; some since.	2 years.
113	R. N.	F.	30	June 11.	Both. Second, right upper, cavity forming; second, left apex; fever; night sweats; anæmia.	3 years.	3 uncles.	Several slight; some since.	2 years.
114	J. C.	M.	24	July 5.	Both. Third, right upper, large cavity; second, left base; fever; night sweats; heart displaced; weak.	3½ yrs.	None.	Several severe; medium since.	2 years.
115	M. H.	F.	25	Nov. 3.	Both. First, both apices; fever; night sweats; weak; meningeal symptoms.	2 mos.	Pat. G. F., 2 uncles, 3 sisters.	None.	2 years.
116	J. M.	M.	21	1883, Sept. 27.	Both. First, right upper, left apex; fever; night sweats; heart weak; poor condition.	2 years.	Father.	Several slight; none since.	2 years.
117	R. H.	M.	33	1883, June 28.	Both. Second, right upper and middle and left apex; fever; night sweats; diarrhœa, dyspepsia; very weak; fibroid.	8 years.	None.	Slight; none since.	2½ mos.
118	J. A.	M.	22	July 14.	Both. First, right upper and part of middle; first, left apex; fever; night sweats; diarrhœa; dyspepsia; heart weak.	2 years.	1 uncle, 1 brother.	Several slight; 1 slight since.	2½ mos.
119	F. S.	M.	26	Nov. 17.	Both. Third, left upper, cavity; second, lower lobe, first right apex; fever; night sweats; very weak.	1½ yrs.	Pat. G. F., 1 uncle.	Several slight; none since.	5 mos.
120	F. L.	M.	22	Nov. 17.	One. Second, right upper; fever; night sweats; weak.	1 year.	None.	Several severe; none since till fatal one.	1½ years.

General Result.	Weight.	Local Result.	Chest Circumference.	Notes.
Improved.	Less.	Fibrosis, with some little clearing.	Increase.	Lives here, and would apparently be well if he did not overwork in office; no chest symptoms.
Improved.	Less.	Right cleared, left partly.	Increase.	Gone to live in Denver, where engaged actively in business; is still improving, though very reckless.
Cure.	Gain.	Cleared up entirely.	Increase.	Lives mostly on ranch; has been on visit to England; returned very well.
Cure.	Gain.	Cleared up.	Increase.	Is very well; lives here and works, but goes East on visits.
Much improved.	Less.	Lung cleared except at extreme apex.	Increase.	Lives here; does well, except when working too hard in office; removal of nasal exostosis with much relief.
Improved.	Less.	Right lung partly cleared; cavities in left contracting.	1 inch increase.	Spent two winters here, summers in Scotland, to which he returned; was stronger when seen last May.
Improved.	Gain.	Much improved; lung clearing slowly.	Increase.	Lives and works here; feels and looks strong.
Cure.	Gain.	All signs disappeared.	Increase.	Returned to New England strong and hearty; has continued well.
Much improved.	Gain.	At first extension and consolidation at right apex, then clearing up of both.	Increase.	Went to Europe; was very strong and hearty when he left; lungs since pronounced well.
Greatly improved.	Gain.	Most of consolidation cleared up and throat improved.	1 inch increase.	Lives in Pueblo; works all day in office; has gained in general vigor and in voice.
Cure.	Gain.	Chest cleared up entirely.	Increase.	Lives here; feels well and strong; actively at work.
Greatly improved.	Less.	Some clearing up of both sides, with fibroid contraction on right.	Increase.	Gone to England for summer, to return in fall; greatly gained in strength; seen in England; doing well.
Improving	Gain.	Small cavity formed in right, which is now contracting; left clearing.	Increase.	Remains here; is tending to improve; disease not fully arrested; general condition good.
Improving	Gain.	Cavity tending to contract; left side cleared up.	Increase.	Lives here; works, feels and looks much stronger.
Cured.	Gain.	All symptoms disappeared.	Increase.	Lives in Denver; looks and feels strong.
Much improved.	Gain.	Consolidation partly cleared, leaving fibrosis of both apices.	Increase.	Went to live on ranch after spending summer in Scotland; strong and well except for rheumatism.
Death.	Less.	Breaking down of both lungs; diarrhœa; heart failure.	Nil.	In first six weeks temporary improvement.
Death.	Less.	Breaking down of right lung; fever; heart failure.	Nil.	First month, less fever, temporary benefit.
Death.	Less.	Breaking down *en masse* in left; extension in right.	Nil.	Went to bed on arrival, and never strong enough to dress and leave room.
Death.	Less.	Improved very much; lung clearing; went East and returned with breaking down and cardiac dilatation.	Nil.	When leaving for home, after a year, was strong and fat, and lung was clearing; returned after two months with breaking down and cardiac dilatation; died from hemorrhage.

No.	Name.	Sex	Age	Date of 1st Visit.	Nature and Extent of Disease.	L'gth of Illness before coming to Col.	Family Predisposition.	Hæmoptysis.	Length of Residence.
121	E. H.	F.	36	1884, Jan. 24.	Both. Third, right upper; second, left lower and first right apex; fever; night sweats; tubercular laryngitis; very weak.	2 years.	Mat. G. mother, 1 aunt.	Slight; none since.	2 mos.
122	T. R.	M.	27	Feb. 4.	Both. Second, both upper lobes; fever; night sweats; weak.	2 years.	None.	Slight; none since.	7½ mos.
123	L. B.	F.	35	June 7.	Both. Third, upper left; second, right; tubercular laryngitis; fever; night sweats; very weak.	2½ yrs.	1 uncle.	None.	3 mos.
124	W. J.	M.	43	July 22.	Both. Third, left upper; second, right upper; fever; night sweats; asthma; cardiac dilatation; weak.	2½ yrs.	1 sister.	None.	3 mos.
125	H. H.	M.	30	1884, Sept. 2.	One. First, right upper; tubercular laryngitis; night sweats; fever; fair strength.	8 mos.	Mother.	None.	1 year.
126	S. H.	M.	32	Oct. 2.	Both. Third, right upper; first, left apex; caries of iliac bone; fever; night sweats; weak.	3½ yrs.	Mother.	None.	4 mos.
127	B. S.	M.	23	Oct. 17.	Both. First, both apices; most at right; chronic laryngitis; no fever; fair strength.	1 year.	Father, pat. G. father.	None.	7 mos.
128	W. H.	M.	36	Nov. 3.	One. Second, left lower; first, left upper; no fever; marked anorexia; weak heart; poor condition.	1 year.	None.	None.	3 mos.
129	S. D.	F.	28	Nov. 4.	Both. Second, left upper and right apex; no fever.	2 years.	Mother, mat. G. M.	Slight; none since.	10 mos.
130	E. P.	M.	40	Nov. 26.	Both. Second, upper left; first, right apex; tubercular laryngitis; anal ulcers; fever; weak.	10 mos.	None.	Slight; none since.	9 mos.
131	W. G.	M.	38	1885, Jan. 16.	One. Second, right upper; slight fever.	6 years.	1 uncle.	Several severe; none since.	1½ yrs.
132	J. C.	M.	42	Jan. 17.	One. First, left upper; no fever; anal fistula; dyspepsia; fair condition.	2 years.	None.	Several slight; few slight since.	2 years.
133	A. B.	M.	32	April 6.	One. Second, right upper; slight fever; anæmic.	1½ yrs.	1 uncle, 2 sisters.	Slight; none since.	2½ yrs.
134	E. A.	F.	26	Jan. 10.	One. Second, left upper and lower; much bronchitis; chronic laryngitis; fair flesh and strength.	2 years.	None.	None.	1 year.
135	J. C.	M.	20	July 23.	Both. Third, left apex; small cavity; second, right apex; fever; sweats; tubercular laryngitis; very weak.	1½ yrs.	2 brothers.	Slight; none since.	4 mos.
136	F. H.	F.	17	Aug. 13.	One. Second, left apex; fever; fair strength.	4 mos.	Mother, tubercular meningitis.	Slight; none since.	8½ mos.
137	L. P.	M.	26	1884, Oct. 24.	Both. Second, left upper; first, right apex; fever; sweats; dyspepsia; weak.	3 years.	Mother.	Several slight; none since.	1 year.
138	T. W.	M.	24	1886, Sept. 14.	Both. Third, left upper; large cavity; first, right lower; fever; sweats; dyspepsia; weak.	14 mos.	Mother, 1 aunt, 1 uncle.	Slight; none since.	2½ yrs.
139	W. W.	M.	26	Oct. 1.	Both. Second, right upper; first, left upper; fever; sweats; weak.	1½ yrs.	None.	Several severe; none since.	4 mos.
140	A. R.	F.	34	Oct. 20.	Both. Second, left upper; second, right apex; fever; sweats; dyspepsia; very weak.	3 years.	None.	None.	5 mos.
141	J. S.	M.	33	—— 20.	Both. Third, right apex, old cavity; one forming at right base; first, left apex, fever; weak.	4½ yrs.	None.	None.	13 mos.

General Result.	Weight.	Local Result.	Chest Circumference.	Notes.
Death.	Less.	Softening of lungs and larynx.	Nil.	Rapid deterioration; went home; died a month later.
Death.	Less.	Rapid softening at last.	Nil.	First four months decided tendency toward arrest; went down rapidly at last; hard drinker; very careless.
Death.	Less.	Cavity formed in left; breaking down began in right laryngitis; worse.	Nil.	Slight improvement first six weeks; then rapid deterioration; sent home; died month later.
Death.	Less.	Rapid and steady deterioration.	Nil.	No check to downward progress.
Death.	Gain.	Extension of disease first few months; then arrest in lung and throat, and relapse after leaving Colorado.	Increase.	He got very strong; laryngeal ulcers healed; lungs partly cleared; went East September 6, 1885; died of tubercular meningitis six months later.
Death.	Less.	Deterioration progressed rapidly.	Nil.	Went home and died two months later.
Death.	Less.	Improvement first four months; then rapid extension and softening.	Nil.	Went home and died in six weeks.
Death.	Less.	Breaking down of left upper lobe; extension in right.	Nil.	Had been hard drinker; no improvement; died with heart failure.
Death.	Less.	Slow, continuous extension of softening.	Increase.	No improvement; had strumous glands; brought up chalk stones.
Death.	Less.	First five months laryngeal ulcers healed and lungs improved; then softening of both.	Increase.	Went to England and died six months later.
Death.	Less.	Cavity formed in right, and extension in left.	Nil.	Never improved.
Death.	Less.	Up to April, 1887, some clearing up below and fibrosis above; on second visit fibrosis extended through lung.	Increase.	Was improving till April, 1887; went to Australia; returned in eight months worse; dyspepsia; ran down, left in Spring of 1888; died year later; free drinker.
Death.	Less.	Some drying and clearing in first year; then large cavity formed.	Increase.	Never any real arrest to the disease; was careful of himself and lived out-of-doors.
Death.	Less.	General breaking down in left lung, and pneumonia at right apex.	Increase.	The case was one where bronchitis was the prominent symptom; it progressed without check; death one year after leaving.
Death.	Less.	Breaking down of both apices; extension below; no check.	Nil.	Deterioration rapid and progressive; went home; died in six weeks.
Death.	Gain.	There was marked improvement in chest; râles becoming dry.	Increase.	The general health, as well as the lung, greatly improved, but tubercular meningitis came on forty-eight hours before death.
Death.	Less.	Large cavity formed in left and small in right; no check.	Nil.	Steady decline.
Death.	Less.	Extension of cavity; tuberculosis through left lower lobe and right upper.	Increase.	First ten months marked improvement in general health and no local advance; went East; returned with signs in right lung and then declined.
Death.	Slight gain.	When leaving cavity forming in right; left improving.	Increase.	While here some general improvement and fever ceased; went to Arizona and died in a year.
Death.	Less.	Excavation in left and breaking down beginning in right.	Nil.	Slight general improvement in first two months, but steady advance in local disease and loss of strength.
Death.	Less.	Large cavity formed at right base.	Nil.	Quite an improvement in general health up to four months before death.

DISCUSSION.

Dr. F. I. Knight.—The papers are exactly what we want. These gentlemen who are living in this locality are, of course, the ones who are especially able to offer us these facts, and it is facts that we need, facts that enable us to discriminate in practice, which will make us differ as specialists from the ordinary routine of the family practitioner; and every year that we accumulate these facts in regard to the particulars of the climate, and in regard to the results of the treatment by climate which Dr. Solly has given us here, the exact results, the more we approximate a definite, scientific knowledge, a knowledge which will be respected by the community. Already, I think, we have gained in the profession a good standing. The American Climatological Association is respected by the profession in general; and I think the community, when it comes to know the work done here, will also appreciate it. We want to discriminate in the climate and in the individual who is to be put under its conditions. Now one of the gentlemen said this morning that there are many consumptive patients which high altitude does not cure. That is very true, but as a rule, I venture to say that those patients ought not to have been sent into high altitude; that we will learn to advise such patients to go to lower altitudes where they can get similar conditions. I hope this work will go on, so that we shall be enabled from our results to say, Do not spend your winter in Denver, but go down to some other place, and go back to Denver for the summer, and so on. Many patients are willing and glad to have a change, and should not be obliged to stay forever in Colorado Springs, but can spend a year or a part of it pleasantly in a different location. And I feel sure that this work will go on, and that it will put us in a very enviable position.

Dr. E. Fletcher Ingals.—I think that the comparison of the cases of the author with those of Dr. Williams is of little value because of the great difference of the character of the patients. The author has certainly selected his cases as nearly properly as he could, and I think he is greatly to be commended for it.

The paper is one ofgreat value to us. It is unfortunate, however, that he has followed so closely the plan adopted by Dr. Williams in classing together all cases in the second and third stages of the disease. Those of the first stage did remarkably in this climate ; those in the second and third stages also did well, but I do not know how many of them were of the third stage and how many were of the second. It has been my belief, and it is commonly accepted, that in the third stage of the disease patients do not do well in a high altitude, and therefore, unless the author can correct this part of the classification, he robs the paper of much of its value, at least to me.

Dr. Solly.—I might mention that when the paper is published I do report the cases separately, but in the gross results I thought it better to follow the suggestion of Dr. Williams.

Dr. Ingals.—There is another defect in the paper which, I think, can be remedied, and which will add to its value. The doctor has unfortunately classed all his patients as residents of Colorado living in a high altitude. Now, with physicians in Colorado this is a good classification, and I have no doubt eminently satisfactory, but physicians outside of the State are liable to think that the doctor wants all patients sent to Colorado, and they will give less credence to his paper than they would if, instead of classing them as patients treated in Colorado, he would simply state that they were treated in a high altitude.

Dr. S. A. Fisk, of Denver.—Mention has been made of a series of 100 cases which I had the pleasure of presenting to the Colorado State Medical Society, in this very hall, somewhat over a year ago. I tried to observe the same conscientiousness in the selection of my cases that Dr. Solly has in his, having reference to my being able to follow them and to speak with knowledge of each individual case, and putting out of the consideration as far as possible, the personal equation, which must always come into the compilation of statistics. I won't attempt to go over the ground again. Sixty-seven per cent of the cases that are sent to Colorado can fairly expect improvement.

With reference to patients that ought to be sent to Colorado, the gentleman from Boston, Dr. Knight, has been exceptionally fortunate in the selection of cases. It seems to me

that he takes into consideration the point which we here recognize as of great importance, being that of a recuperative power, as shown by the ability to eat and assimilate. A prime factor with reference to climatic treatment of phthisis, whether it be in this climate or anywhere else, is the ability of the patient to be out of doors, as enabling him to improve his nutrition. Now we have a climate here in Colorado that admits of a great deal of out-door life in the winter time, and that is the important time to consider. Even in mid-winter the days are so warm that it is possible for the patient to be out of doors nearly every day. At mid-day we have a temperature ranging from 62 degrees upward, so that the most of us go without overcoats. The sun rises very early here—about seven o'clock in the morning; it strikes the dry soil and warms up the air. When it is time for the patient to go out of doors, about nine or ten o'clock in the morning, he finds the air warm and agreeable. Sunshine is another element. We have 320 days of sunshine out of 365. The number of hours each day that the patient can be out of doors compared with other high altitudes, I think, is nearly two to one.

It is like a patient tumbling out of bed into a cold atmosphere in his room, or having a fire built there first. I mention these points because they enable the patient to live out of doors. The prime principle laid down with reference to climatic treatment is that out-of-door life improves the nutrition. This is a prime factor. One reason why better results are not obtained with reference to climatic treatment of disease here, as well as elsewhere, I presume is the fact that the question of exercise cannot be properly regulated. It is one of the most difficult questions to regulate that the doctor has to meet. It cannot be laid down as an invariable rule that consumptive patients should take violent exercise. There are those who advocate rest. In each individual case it is a nice point to determine. In my 100 cases I found something like 25 per cent of deaths. Looking over this 25 per cent of deaths, I find that there were patients who had every reason to expect very marked improvement, and who were gaining and doing admirably well up to a certain point, when they committed an imprudence which turned the scale. I have in mind a case, probably well known to some of you, who was doing admirably well until he

took a long horseback ride. He rode 20 miles hard with a companion who was a strong man. When he came in he had a hemorrhage, and instead of keeping quiet, he was imprudent, and his hemorrhages went from bad to worse. He had rapid and profuse hemorrhages, and he never rallied. I have in mind another case, of a young man who could have been classed as almost, if not quite cured, when he took part in a negro minstrel show, contracted pneumonia and died. Such cases are frequent here. Every one who has practised in Colorado knows how hard it is to regulate the conduct of the patient. Now, for my part, where the patients come here from the East, I insist, no matter what the stage of the disease, that they shall be kept quiet at first. They come from a sea-level to an altitude one mile above the sea-level, from an atmospheric pressure of 15 pounds to the square inch to one of 12½.

The burden of my advice to them is: Rest; keep quiet; there is no hurry about seeing Denver; sit in the sun and breathe the fresh air and get your sleep regularly. Then, after a month of quiet, I let them exercise a little, but keep them moderately quiet for several months; not until later on do they begin to climb mountains. It seems to me that where there is much progress of the disease as shown by an elevated temperature in the afternoon, patients, no matter how long they have been here, should be kept quiet. I frequently put my patients absolutely at rest in bed and keep them there until I get control of the temperature.

With reference to the several stages of the disease, in the selection of the cases to be sent out here, while in general terms I would agree with Dr. Ingals, that persons in the third stage should not be sent, yet I would take into consideration probably more than that the recuperative power of the individual as shown by his ability to eat and digest, and the absence of fever, because I suppose we all are agreed that the high altitude is not suited to acute conditions. I have in mind a great many patients who have come here with cavities, but who had recuperative power, who could eat well, and whose stomachs never troubled them, who could sleep well, and who have done admirably well. I have in mind now a gentleman living out on a ranch. If you could see him, you would con-

sider him one of the healthiest specimens in the whole State. He is conducting a large ranch, but has quite a cavity in one lung. He is good for many years yet. He goes back to England (his home) occasionally, and I think he is a fair illustration that patients even in the third stage may be sent here, provided they have recuperative power. I have seen persons in the earliest stage go down very rapidly, nervous women who cannot retain food sink rapidly and pass away in a few months, while other persons with cavities, who eat and digest, and can be out of doors, have gotten well.

Dr. Bowditch.—This brings to my mind very forcibly the question of sanitariums. Dr. Fisk speaks of the frequent possibility of the patient committing indiscretions which put him back months in the progress toward recovery. I do not know the feeling of the physicians here, but I have noticed a tendency in the direction of founding sanitariums for the proper supervision of patients. I feel that the chief thing is the proper supervision of those who come here for climatic treatment, and I sincerely trust that as time goes on institutions of this sort will become common here.

Dr. Curtin.—Dr. Fisk's suggestions are good indeed, but what about the life and health of the children of consumptive patients in Colorado?

Dr. Solly.—I have not any statistics on that point, but having lived here sixteen years, I have seen children of consumptive parents grow up, many of them in Colorado Springs, and it is a rare thing to see an unhealthy child among them. They are, for the most part, remarkably healthy. The parents of the children are often both consumptives, because there have been many marriages between consumptives there. I attribute their good health to the open air life they are able to lead.

Dr. Denison.—We are grateful to Dr. Solly for his presentation of the record of cases. No one knows better than he who has tried to record the cases which he has had for a given space of time, how difficult it is. I know when I had 205 cases, which I tried to record and bring to mind so I could state the present condition and give a fair statement of just how the cases resulted, seven cases at a time was all I could manage. We appreciate the value of the statistics thus given to us. They will add materially to the records that have been presented heretofore, as will also Dr. Fisk's.

NERVOUS AND MENTAL DISEASES OBSERVED IN COLORADO.

By J. T. Eskridge, M.D., Denver, Col., formerly Post-Graduate Instructor in Nervous Diseases in the Jefferson Medical College and Physician to the Hospital of the College, etc.

In a communication to the Philadelphia Neurological Society, in September, 1887, I gave the results of three years' observation of the climate of Colorado on nervous and mental diseases, together with the views of several physicians in various portions of the State, practising at altitudes varying from 4000 to 10,000 feet. In the present paper I can add three years' additional observations on the same subject. Two years of this time have been spent in Denver, where the field of observation has been much enlarged, owing to the size of the city and the hospital accommodations, which have enabled me to study cases from nearly every portion of the State.

In my former paper I stated that "among the inhabitants of Colorado we find more leisure in many places and a greater tendency to keep late hours and indulge in various dissipations than is common farther East. Many go to Colorado in search of health, and the separation from relatives and friends, added to the enforced idleness, is a source of worry and a certain amount of nervousness. Some go to better their fortunes, and, for these, investments in mines and various other uncertain speculations cause anxiety and unwonted excitement. Many who had lived quiet lives and kept regular hours for rest and eating in the Eastern States go to Colorado, overindulge in the use of alcohol and tobacco, and try their nervous systems by late and irregular hours. After allowing for all the modifying influences, exclusive of climate, I feel confident that by a careful comparison of certain nervous disturbances at sea-level with those of like nature met with in high and dry mountainous regions a difference will be found to exist; but the difference is much less than the exaggerated statements made by the laity here concerning the influence of Colorado climate on the nervous system would at first lead us to be-

lieve. That among the people of Colorado we have more of what is termed nervousness than exists in the same number of inhabitants at sea-level there can be no doubt, but consumptive invalids form a greater proportion of the population in Colorado than is found farther East."

Most of the statements just quoted hold good to-day in certain portions of Colorado, especially in Colorado Springs, where I resided when the observations were made. In Denver, where I have made my observations during the past two years, there are less idleness and fewer consumptives in proportion to the population, but more business worry and bustle, and probably more irregular living, than in places like Colorado Springs and Manitou, where a greater proportion of the inhabitants have gone more for health than for business. If we take the people of Denver and compare them with a similar number in one of the wide-awake and business-going cities of the East, such as New York or Chicago, we shall find their habits and methods of doing business so nearly alike that but little difference in influence on the nervous system, except climatal, will be found to exist in Denver that is not active in the Eastern cities.

Most of my observations on the influence of Colorado climate on the nervous system have not been conducted by strictly scientific methods, but rather by comparing clinical observations made in Colorado with those made in Philadelphia, extending over a number of years. It must be borne in mind that conclusions reached by this method are distorted more or less by personal equation, the degree of inaccuracy depending largely upon the carefulness and faithfulness of the observer. A few facts, however, have been ascertained by strictly scientific procedure. While practising in Philadelphia I devoted considerable time to surface-temperature observation, both in health and in disease. The number of observations amounted to several thousands, taken over various portions of the body. During the last four or five years I have continued these observations in Colorado, limiting the area mainly, but not exclusively, to the surface of the head. After allowing for changes in the mercurial thermometers, which time invariably effects, I find that the normal head temperature in Colorado is about half a degree (F.) higher than in Philadelphia.

I have also endeavored to compare the surface temperature of the body at various altitudes, but observations made at high altitudes, especially on Pike's Peak, owing to danger to my health in ascending high mountains, had to be intrusted to others, and I fear have but little value. No one unaccustomed to making surface temperature observations realizes the amount of care necessary to prevent inaccuracies. Time and time again I have requested my assistants to make such temperature observations for me, and I have repeated the observations a few minutes later and have gotten different results, the difference varying from a quarter of a degree to a degree.

Increased surface temperature in Colorado is what most clinical observers had inferred long before my observations, but the supposed condition, scientifically confirmed, becomes a fact and may help to explain many modifying influences the climate has on the functions of the organs of the body.

Mental Work.—I have often asked myself the question, and not infrequently propounded the query to others, whether a person is able to do more or less mental work in Colorado than at sea-level. The kind of mental work I refer to is hard study for several hours each day, continued over several weeks. The answer I have obtained from most persons whom I have interrogated on this subject is that they have not compared the effects and were undecided as to the results. I have tried to compare the effects on my own person, as I gave a few hours each day to hard mental work for many consecutive weeks in each year while practising in Philadelphia, and much of the time since coming to Colorado, when my health would permit of it. I have devoted more or less time each day to mental work. I feel that the conclusions at which I have arrived from personal experience may be open to objection. My physical power of endurance is much lessened since I contracted lung trouble, for which I came to Colorado, and, in consequence, mental effort sooner results in fatigue. I have found that three or four hours each day devoted to continuous mental work and extended over a period of a few weeks so weakens and prostrates me that I am compelled to give up all reading, except light literature, for a time. When I have felt fresh and have had a zest for study, I have thought I could accomplish more in a given time than I was able to do at a low

altitude ; but this is merely surmise on my part. The only persons who can approximate an accurate solution of this subject are those who, in good health, accustomed to do a regular amount of study East, have come to Colorado in the same state of health to pursue similar studies to those engaged in while East.

Sleep and Insomnia.—Under this heading in my former paper, the unanimous opinion of the physicians was that sleep was more easily obtained, more continuous, and more refreshing in Colorado than at sea-level. We have several classes in which to study the effects of the climate on the production of sleep, or as a cause of insomnia. Among these may be mentioned the tourist, including the business adventurer ; the tired and overworked, both mentally and physically ; and the health-seeker, especially the consumptive person.

On tourists or adventurers the effects are as varied as the temperaments of the individuals, and are modified by the habits and life of such persons while in Colorado. The restless ones among this class, who are never satisfied, but must have continuous excitement in scenery or some other diversion, rarely get good and refreshing sleep in Colorado unless tired out by physical exhaustion, when they run the risk of developing a temporary irritable heart, disturbances in digestion, and headache. Such persons frequently leave the State complaining bitterly of the evil effects of the climate on healthy individuals.

Those of this class who take things leisurely, more as a natural result of their temperaments than from the warnings of others who have been indiscreet, do not over-exercise, and allow themselves time for regular meals and rest, rarely fail to get prolonged and refreshing sleep.

About the only practical deductions to be derived from a study of the experiences of the tourists in Colorado are what to avoid in the invalid class.

The Overworked.—In this class are included the tired business and professional man, whose mental strain compels sedentary habits, neglect of proper exercise, and irregular hours for eating and sleeping, and the lady of family cares, as well as she whose vigor has been sapped by the unreasonable exactions of fashionable life. To these a visit to Colorado means, in

the majority of cases, if too much physical exercise is not indulged in, prolonged and refreshing sleep. Such persons coming here from the East regain their strength rapidly ; but we must not attribute all the good results to Colorado climate. Habits and modes of living for the time being are changed. The business man leaves worry and care behind ; the professional man, relieved of the trials, annoyances, and anxious cares of his profession, seeks rest amid new scenes, while she who had been sore pressed with family cares and social obligations changes these for a quiet life. Much of the relief comes from "the change," irrespective of climate.

Having had an opportunity for a number of years, before coming to Colorado, of studying the effect of sea-shore resorts on this class of persons, I found a greater proportion unrelieved from insomnia than I find to be the case with those who seek rest and change among the mountains of Colorado, provided that a sufficiently quiet life is led here. According to the writer's experience, it is a rare exception for insomnia to continue in such persons after coming to Colorado, excluding a few cases of supposed active hyperæmia of the brain or irritable heart, reference to which will be made later.

Health-seekers.—I have found no reasons for changing the statements that I made three years ago : "That for the majority of persons, especially for the consumptive invalids, sleep is more easily obtained, more continuous, and more refreshing in Colorado than in the Eastern States. The tired, ill-nourished, and overworked person, who spent sleepless nights East, goes to Colorado and finds, as his nutrition improves, that sleep is prolonged and unusually refreshing. Cool nights throughout the summer season, as a rule, enable persons to get much more sleep and rest in Colorado than can be obtained at sea-level during this portion of the year. Some, on going to Colorado, are unable to sleep well for a few nights, or perhaps weeks, while others get prolonged and refreshing sleep from the first. Those belonging to the latter group are much the more numerous. Those whose sleep is disturbed on first going to places of considerable altitude usually enjoy a sufficient amount of sleep for several months after they begin to rest well, but I doubt whether these are ever able to sleep as much as those who rest well on first going to high mountain-

ous regions. There is a popular and almost universal belief among the laity, and physicians share this opinion, that one wears out the good effects of the climate after a few years' continuous residence in Colorado. I am firmly convinced, both from observations and from inquiries among those who have resided here a considerable length of time, that there is a great deal of truth in this prevailing opinion. Those who lead idle or sedentary lives are, I think, more liable to become sleepless after a considerable stay here than those who keep profitably employed in work that requires more or less exercise. Much severe mental work at high altitudes would be, I think, more likely to be followed by sleeplessness than the same done at sea-level. Tobacco, alcohol, tea, and coffee, if indulged in immoderately, apparently injuriously affect sleep more at high altitudes than the same indiscretions do at low elevations."

While the majority of persons who come to Colorado get refreshing sleep for a number of months, and in some instances for years, yet there are a few nervous, hysterical individuals who find great difficulty in getting refreshing sleep here. They are not able to sleep a sufficient number of hours, and the time for repose is frequently spent in broken sleep. Cases of insomnia in the East, due to active hyperæmia of the brain that is not relieved by rest, sleep poorly, I think, in Colorado. At least this has been my experience with cases of the kind. Dr. Anderson, of Colorado Springs, and Dr. Sears, of Leadville, both say that cases of cerebral hyperæmia sleep well at each of the last-named places. I am inclined to believe that they have not distinguished, in their communications to me, between active and passive hyperæmia. I am led to believe, from observations, that cases of passive hyperæmia, or venous stasis of the brain, due to mental overwork, worry, loss of sleep, etc., are able to obtain abundant and refreshing sleep. I believe also that insomnia due to organic brain changes or active hyperæmia is made worse in Colorado. In my former paper I stated that "it is very difficult to say whether medium (4000 to 6000 feet) elevations, or the higher (7000 to 11,000 feet), are the better for cases of insomnia." During the last three years I have known of a few persons who have come to the medium elevations, slept well for a time, then, becoming

more or less sleepless, have gone to the higher altitudes, where they again slept well. I think such cases are rare. But, on the contrary, we frequently find that persons who become troubled with insomnia in the higher altitudes, where they had slept fairly well for a length of time, coming to the medium elevations of Colorado obtain refreshing and prolonged sleep. Pure air, good weather, and the amount of bright sunshine, even in winter, inviting persons to live outdoors a good portion of the time and take more exercise than they were accustomed to do East, are important agents in enabling one to get refreshing sleep in Colorado. What lessened atmospheric pressure has to do with inducing sleep, making it more profound, as some who reside in very high altitudes maintain, has yet to be determined. Those who have had experience with the pneumatic cabinet, and have noted the sensations experienced by their patients, may be able to enlighten us on this subject.

Irritable Nervous System, or Nervousness.—The opinions of the physicians of Colorado differ widely respecting the influence of the climate on a delicate and irritable nervous system, some believing the influence is great, and others that it is slight, if any exists.

An additional three years' experience with nervous affections found in Colorado enables me to emphasize what I said on this subject three years ago: "From what I have learned from observations and inquiry, I have no hesitation in saying that the inherent nervous temperaments—not those who are nervous from malnutrition, which the climate may and does remove in many instances—are made worse by a prolonged residence in Colorado. Further, I believe, and I think I am expressing the opinions of a number of physicians there, that many who are not usually considered nervous become so after a prolonged residence in Colorado." The nervousness may manifest itself by sleeplessness, irritable heart, with a tendency to passive congestion, especially of the gastro-intestinal mucous membrane, by a loss of appetite, failure of strength, lessened power of endurance, and considerable loss in body weight. Some suffer from restlessness and irritability of temper, and some complain of inability to concentrate the mind long on any subject. Persons thus affected and contemplating making

their home in Colorado should not try to overcome their sensations by a prolonged and uninterrupted stay here, but they should try to spend a month or two each year at sea-level, which is almost invariably followed by an improved condition of the nervous symptoms.

Dr. Reed, of Colorado Springs, informed me that he had observed that child-bearing nervous women, after a prolonged stay in Colorado, recover less satisfactorily from the trying ordeals of the lying-in room after the birth of the second or third child than they had done after the first. The intensely bright sunshine, and the great amount of it, which is the boast of Coloradians, the dry atmosphere, and the winds, it seems to me, are factors in irritating an already irritable nervous system. Some have tried to lay the cause at the door of lessened atmospheric pressure. This may have something to do with it, but how much it is impossible to say.

Before beginning this paper I was informed that Dr. H. A. Lemen, who has practised medicine in Colorado for a number of years and paid especial attention to diseases of women, would write on the influence of climate on women. I regret that his engagements have been such that he has been unable to contribute a paper on this subject. That the nervous system of woman is more irritable than that of man every one will admit, and that she in consequence suffers more from the irritating effects of our climate is self-evident. My note-book shows that a large percentage of those who suffer from the irritating effects of this climate is composed of women ; but I will not go into details, hoping that Dr. Lemen, at some future time, will take up this subject and elaborate it.

Hysteria.—Three years ago I was able to give the results of the experience of various physicians with this protean disease as it occurs in the smaller towns in the State, and of my observations of it in Colorado Springs. My conclusions were then that it was of lighter form, shorter duration, and much less frequent in proportion to the population than observed in the large Eastern cities, but at the same time I endeavored to account for the infrequency from the habits of the people and their surroundings, and expressed an opinion that had we in Colorado all the conditions of a large Eastern city favorable for the development of hysteria, it would be found more fre-

quent here than it is in cities at sea-level. Two years' experience in Denver, where conditions favoring the development and manifestation of the disease exist, convinces me that hysteria is not infrequent here, and that it is found in all forms, from the mildest to the severest. I have witnessed three cases in the male. From my present experience I am unable to say that the disease is of shorter duration and yields more readily to treatment than is found in the eastern portion of this country.

Chronic Alcoholism and the Opium Habit.—What must impress itself on every observer in Denver is the immense number suffering from the chronic effects of alcohol and opium. Other causes than climatal may account for this. A large proportion of those whom I have had an opportunity to interrogate on this subject admit having been addicted to the habit before coming to Colorado. Denver during the last few years has been the Mecca sought by those broken down financially, and in this class alcoholism and the opium habit are common. Whether there is anything in the climate of Colorado tending to indulgence in alcohol and opium more than what is found at sea-level I am unable to say. Whether a larger proportion of the population here has begun the overuse of alcohol, or contracted the opium habit, in Colorado, than is found at sea-level, many years of carefully studied statistics must answer.

Chorea.—The physicians who favored me with their experiences with chorea three years ago were almost unanimous in their opinions that the disease is more frequent, severer, of longer duration, and less amenable to treatment in Colorado than at sea-level. I then expressed the opinion, from an experience with the disease in Colorado Springs, that it was unfavorably influenced by the climate.

Some of the physicians who were kind enough to answer my inquiries stated that they invariably sent all their cases of chorea to lower altitudes, with decided benefit to their patients.

During the past three years I have had the opportunity of treating and seeing in consultation numerous cases of chorea in Denver. So far, without a single exception, they have yielded to the ordinary treatment for this disease. Some cases have

developed at low altitudes, and from force of circumstances have been brought to this city. These have yielded to treatment, but in one case the movements at first seemed to be exaggerated by the change to this altitude. My treatment has invariably been, in cases where the choreic movements were great, full doses of antipyrine or phenacetin until the movements had nearly ceased, when Fowler's solution of arsenic has been carried to the point of toleration, the dose reached in some cases being eighteen or twenty drops thrice daily. My former statements will have to be modified by saying that chorea at this altitude (about 5000 feet) seems to yield about as readily as at sea-level, and with no greater tendency to relapses.

Neuralgia.—A more extended experience convinces me that neuralgia is a much less troublesome and less frequent disease in Colorado than in low malarial districts. I have seen several cases of malarial neuralgia rapidly yield after coming to Colorado.

Migraine seems to be favorably modified on first coming to Colorado, but the attacks are not broken up, and, after a few months, the trouble returns and seems to be more persistent than it was at low altitudes.

In some of these sufferers, upon a return to a low altitude after they had spent some months in Colorado, long intervals with entire freedom from the disease have resulted.

Multiple Neuritis.—During the last six months I have seen six cases of this disease. So far I have been unable to discover any points of difference between the course, severity, and duration of the disease here and at low altitudes.

Epilepsy.—In my former communication the answers of the physicians in reply to my inquiries concerning the influence of the climate on epilepsy varied so greatly that no conclusion could be arrived at; some believed that the disease was unfavorably influenced by a resort to this climate, that it quite frequently originated here and proved rebellious to treatment; others thought it was uninfluenced by the climate, while some thought it was a very infrequent disease in Colorado.

I have had an opportunity of personally studying twenty-one cases of epilepsy since coming to Colorado. Sixteen of the twenty-one originated at low altitudes outside of Colorado,

leaving five cases which began in some portion of the State. Of the Colorado group, the age at which the disease began was at the second, third, fourth, seventh, and thirtieth year, respectively. Of the imported cases, three began at the second, two at the fourth, six at the tenth, three at the sixteenth, one at the thirty-third, and one at the thirty-seventh year.

Causes.—Of the Colorado group, in one, injury to head from a fall ; in one, hydrocephalus, and in three the cause is unknown. Of the imported cases, gastro-intestinal disturbances in infancy seemed to be the exciting cause in four, injury to head in five, and unknown in eight.

Sex.—Colorado group, three males, two females. Imported cases, there were fifteen males and one female.

Severe or Light Attacks.—In the Colorado cases three suffered only from the light or *petit mal*, and in two the *grand* and *petit mal* were found. In the imported cases all suffered from the severer manifestations of the disease, although a few also had occasional *petit-mal* attacks.

Time.—Of the Colorado cases, in one the seizures were limited to the waking hours, and in the other four they occurred both diurnally and nocturnally. Of the imported cases, in only one were the seizures of the diurnal character, and in the other fifteen the attacks occurred indifferently both day and night. So far I have not seen a case of epilepsy in Colorado in which the attacks were limited to the sleeping hours.*

Mental Effect.—Of the Colorado cases, there is decided mental failure in three, and in two the mind seems unaffected. Of the imported cases, insanity has developed in four and mental failure in ten, and in two the mind seems well preserved. In all of the Colorado cases treatment has seemed to be attended with the usual results found at low altitudes. The result of the climate on the sixteen imported patients is hard to determine. Two were excitable and unmanageable at times before coming to Colorado. These were soon decided to be insane after coming to this State, and one has since died in a condition of status epilepticus. On the fourteen others the climate had no appreciable effect. It will be observed that only one female epileptic is found among the

* Since this was written, a case of epilepsy with attacks only in the early morning hours (four or five o'clock) has come under my observation.

sixteen coming from a distance to Colorado. This is accounted for from the fact that female epileptics rarely leave home. I have been unable to perceive that the climate of Colorado, especially at Denver, materially modifies the course of epilepsy, except, it may be, for a short time after the arrival of such patients here, when the disease is frequently benefited if the person keeps sufficiently quiet.

Insanity.—Since coming to Denver I find it even more difficult to determine the influence of Colorado climate on the insane and in the causation of insanity than I did while practising in Colorado Springs. Of the one hundred cases of insanity of which I have records of having seen during the past year in this city, about fifty per cent were insane before coming to Colorado, and ten of the remaining fifty became insane in other portions of Colorado than Denver. During June of the present year I saw nine cases of insanity, six of which, so far as could be learned, developed in Colorado, but only four of these in Denver. From the 1st to the 19th of August I saw sixteen cases, only seven of which developed in Colorado. In July I saw six cases, three of which developed in Colorado and three outside the State.

This State has not as yet made adequate provision for the care of her insane, and some of the adjoining States and Territories are behind Colorado in caring for their insane, and, in consequence, there is a small insane nomadic population that travel from State to State and from city to city, as they can succeed in obtaining from county commissioners free transportation. As jury trials are expensive to adjudge persons of unsound mind insane, it sometimes happens that the cheapest way to get rid of such persons is to send them to an adjoining county or State.

Until Colorado succeeds in establishing ample accommodation for her insane, and until we can get the records of every case of insanity developing in the State and leaving it, it will be impossible to ascertain our insane population. It is evident that the proportion of our insane population in this State is rapidly increasing, but how fast statistics give us no idea.

Some patients with insanity, especially of the maniacal form, are benefited on being removed to a lower altitude. The number of cases of insanity developing in Colorado and

taking a depressive form far outnumber those of an expansive nature. As yet there is no private asylum in the State where the insane with means to defray their own expenses can be cared for, and in consequence all such are sent to Eastern asylums.

Temporary Effects of High Altitudes.—Many go to the summit of high mountains and experience no inconvenience, while others at times can perform such feats with impunity, but at other times, depending probably upon the condition of their health, find mental or physical symptoms are produced thereby, and yet a third class is almost invariably inconvenienced by high altitudes. The following case reported in a former paper is to the point: "An intelligent young man, a tutor, in excellent health, started from Manitou early one morning in June, 1887, to go on horseback to the summit of Pike's Peak. The distance is about twelve miles. He had eaten a fair breakfast, but took no stimulants that day, either before or during the trip. He accomplished the ascent of the mountain in a few hours, in company with several others, and experienced no inconvenience. The party remained on the Peak about two hours before beginning the descent. Nothing peculiar was noticed in the young man until he had descended about 2000 feet, when some of the party observed his strange remarks and absent-minded condition. It was found on inquiry that he had forgotten nearly everything that had occurred during the day. When he reached Manitou, late in the afternoon, he did not remember at what hotel he had been stopping. He had paid for the hire of his horse, and his guide for his services, in the morning before starting, but on returning had forgotten all about it. When he reached his room in his hotel he had forgotten what he had done with his horse, and started to look for him. He remained in this confused and amnesic condition about thirty-six hours. I fortunately had an opportunity to interview him a few days after the strange occurrence. At the time of my conversation with him he said that he then remembered every incident of the day's journey, of which he was oblivious on the day of the ascent of the Peak. He told me he was not conscious at the time that anything was wrong with his memory, but was conscious of saying foolish things to which he could not help giving expres-

sion. He could afterward recall his dazed condition, loss of memory, and the laughter which he provoked among his party. He stated that he had on previous occasions ascended high mountains, some as high and some higher than Pike's Peak, but never before had had a similar experience from mountain climbing."

I have reported this case in full, as it illustrates a freak of memory found in a recent case of insanity which came under my experience. In July, 1887, a gentleman from Boston, member of a mountain climbing club, went to Estes Park, at an elevation of between 8000 and 9000 feet. At the end of a week or two he felt, as he expressed it, as though he were in a furnace, a sensation of intense heat, and began to lose flesh rapidly. In July of the present year (1890) I met an Englishman who had been in this country only a short time. He, in company with a number of gentlemen, was driving over some of the high ranges in the neighborhood of Leadville, at an altitude of 11,000 feet. He felt well and was quite hilarious, but suddenly became paretic in his legs and was unable to stand without assistance from a person on each side of him. He experienced no pain. The paresis disappeared as he reached a lower altitude, and he has had no difficulty in walking since. I have heard of one other who was mentally confused in making the ascent of high mountains in Colorado.

So far I have had nothing interesting to report from Professor Pickering, of the Astronomical Department of the Harvard University, owing to the fact that Pike's Peak was abandoned by him and his assistants after the first year (1887) as a point for observation.

Inflammatory Lesions of the Brain and Cord.—Under this division of my paper, read in 1887 before the Philadelphia Neurological Society, I gave the opinions of several physicians of Colorado in respect to the influence of the climate. Most of them thought inflammatory lesions of the brain and cord comparatively rare. Dr. Anderson, of Colorado Springs, stated: "The only lesion of the brain with which I have had any experience here has been softening, and I would say, from experience, that long residence in high altitudes is one of the most prolific sources of this affection. A number of cases in 'old timers' have come under my observation, and have

proved fatal." Dr. Jacob Reed, Jr., of the same place, thought that he had met with tubercular meningitis more frequently in Colorado Springs than he had in the same number of children either in Philadelphia or Michigan. So far as I know, only three cases of tubercular meningitis occurred in Colorado Springs from 1884 to 1887. The population during these years averaged about 6000. I do not know the percentage of deaths from tubercular meningitis that occur in the Eastern towns the size of Colorado Springs. One death annually in a population of 6000 seems to me comparatively small, and if we take into consideration the large proportion of the children of Colorado Springs born of consumptive parents, the death-rate is proportionately smaller to the consumptive population. It might be that the open-air life led by the children, and the bracing effects of the atmosphere, together with cool nights, even in midsummer, insuring refreshing sleep, enable the issue of consumptive parents to overcome the tendency to the development of the disease. Certainly this seems to be the case with reference to the development of tuberculosis of the lungs in children that are born and reside in Colorado. The dryness of the atmosphere favoring free perspiration is evidently a factor in the prevention of tuberculous and other inflammation of the central nervous system. My experience in Denver leads me to believe that tuberculous affections of the brain are proportionately larger here than in Colorado Springs. During my fourth year in Colorado Springs I saw two cases of infantile paralysis; none during the previous three years. I have observed only four such cases during two years in Denver. I did not hear of a single case of non-traumatic and non-tubercular meningitis during four years' residence in Colorado Springs, and have heard of only one during the past two years in Denver. I have studied six cases of acute myelitis—one of tumor of the cord, five of tumor of the brain, and eleven of chronic systemic degeneration of the cord—during the past two years in Denver, and have been unable to find any points of difference in the histories and progress between these troubles here and those of like nature observed at sea-level. Of their comparative frequency in this altitude I am unable to form an opinion, as most of the cases of gross lesions of the central nervous sys-

tem observed here have been seen in hospitals in patients from various portions of the State. It is probable that persons suffering from chronic degenerative conditions of the cord experience an apparent improvement in their nervous conditions on coming to Colorado, not, I believe, from the direct influence of the climate on their nervous affections, but, indirectly, on account of improved condition resulting from the stimulating and bracing effects of the atmosphere. Dr. Solly thinks he has seen temporary good effects produced by a residence in Colorado on chronic inflammatory lesions of the cord.

Chronic Degeneration of the Brain.—That mental failure begins earlier in life in persons who have lived and struggled for many years in Colorado, and is in many cases attended by symptoms of chronic degeneration of the brain more frequently than is the case in similar individuals East, is recognized by the profession and laity generally. That this belief is correct, after six years' observation, I have no doubt. The practical question is, Is it due to long residence in high altitudes, as many maintain, or has it been caused by something peculiar, or at least prominent, in the lives and business habits of Colorado's pioneers? To answer this inquiry intelligently, we must consider several factors in the lives of these men. These persons lived in Colorado many years, surrounded by treacherous Indians and still more treacherous desperadoes. The mining interests of the State from 1859 to 1870 were her main and almost her sole resource for those seeking wealth. The uncertainty of fortune and the feverish excitement in the speculative miner's life—prospective millions to-day, realized poverty to-morrow—kept them under great mental strain. For some, to the prolonged mental excitement and worry we may add irregular hours for eating, often insufficient food and sleep for days, and no relaxation for years; and for others we may still add indulgences in alcoholic and venereal excesses; and still for a third class, gambling. Are not these causes sufficient to wear a man out at any altitude and in any climate? What is the cause of the early mental and physical wreck seen in so many of the Wall Street brokers and railroad magnates? Is it altitude? Certainly not. Then why attribute so much to high altitude as the factor determining the early break-down of persons who have crowded so much worry and

mental excitement into so short a space of time? Again, some of the pioneers brought their wives to Colorado with them, and if altitude was the great cause of mental failure, these too should suffer in a similar manner. Practically this is not the case. The female often becomes nervous and sleepless, but she does not suffer in Colorado from chronic brain degeneration in the same proportion as the male sex. I fortunately have had opportunities to examine the brains and blood-vessels of some who have suffered and died in Colorado, comparatively early in life, from chronic brain degeneration. The blood-vessels have been found diseased in every case, and in some slight chronic meningitis has co-existed. I believe arteritis is the primary lesion in the majority of cases of early mental break-down in Colorado. The climate may, and doubtless does, play a small part in the matter, but not nearly so great as has been popularly attributed to it.

Apoplexy.—Three years ago Dr. Strickler, of Colorado Springs, with an experience of seventeen years there, and Dr. B. P. Anderson, with ten or twelve years' experience in the same place, stated that they had not seen a case of cerebral hæmorrhagic apoplexy in Colorado. This struck me as being very strange, and after referring to three cases of apoplexy that I had seen, or of which I had personal knowledge, occurring in Colorado Springs in 1887, I added: "I see no reason why hæmorrhagic apoplexy should not be as frequent in Colorado as we find it at sea-level." During the last eighteen months I have either had under my own care, or seen in consultation with other physicians, seventeen cases of apoplexy. I doubt if the climate has much to do *per se* in the production of apoplexy, but I do believe that violent exercise in high altitudes in persons with weak cerebral arteries is more dangerous than in such persons at low altitudes.

Sunstroke or heat stroke is almost unknown in Colorado. A few years ago it was said never to have been known to occur here. Its absence is accounted for by the active capillary circulation of the skin, by the free evaporation of moisture from the surface of the body, and by the increased amount of watery vapor given off from the pulmonary mucous membrane into the rarefied and dry air. During the summer of 1889 I saw a man who had been overcome and who died from the

effects of the heat while working in the Grant Smelter of this city. The day was warm and sultry for Colorado. The man was working near one of the large furnaces in the smelter, and his death was due to artificial heat.

Paræsthesia.—Two cases of paræsthesia, one of which was seemingly due to high altitude, have recently come under my observation. After studying them more fully, if they should prove to be as interesting as they now seem, I intend to publish a detailed account of them.

TRANSACTIONS OF THE SEVENTH ANNUAL MEETING OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION, HELD AT DENVER, COL., SEPTEMBER 2, 3, AND 4, 1890.

DISCUSSION.

Dr. Solly: During a practice in Colorado extending over nearly sixteen years I have seen and treated quite a number and variety of nervous cases. The views I have formed from this experience agree with the conclusions Dr. Eskridge has arrived at from his wider experience and knowledge as a specialist of nervous diseases.

Concerning tubercular meningitis, in the one hundred and forty-one cases of consumption I reported to-day, there were only two with this complication. In both of these there was improvement in lung symptoms, and a general apparent improvement up to the time of the fatal attack of tubercular meningitis. I only remember two other cases of tubercular meningitis in my own practice among adults. I also fail to recollect more than one child of consumptive parentage who developed this disease. This one I saw in consultation. The child was a year old and born after the parent developed phthisis.

Dr. Denison: It may be of interest in the same direction that Dr. Solly was mentioning—I don't know whether the number is an extravagant one for the number of patients I have seen, but I am inclined to think it is—but I have seen seven cases of death by tubercular meningitis, all consumptives. Most of these were of a fibroid nature, and the phthisis seemed to be arrested; nevertheless, they died of tubercular meningitis. The fact that Dr. Solly mentions was also true in those cases; the lungs had been improved. It is my idea, had the lungs not been improved the disease would not have manifested itself as far as the nervous system is concerned; in other words, they would have died of the lung disease. Ventilation

of the lungs led to healthy activity of the lungs, but the germs were still in the system, and manifested themselves in the brain through some temporary excitement, or some other cause for meningeal inflammation.

Dr. Eskridge: I would like to say that the form of tubercular meningitis I refer to especially is the tubercular meningitis of the child of consumptive parents. It is an interesting point to determine how consumptive patients frequently die in Colorado from tubercular inflammation or infiltration of the membranes of the brain. It is well known by physicians practising in the East that not a very small proportion of consumptives there die from tubercular inflammation of the brain-membranes. I know in my wards in the hospitals in Philadelphia, during each winter there would be an average of about twelve beds devoted to the care of consumptives, and usually we had from one to three deaths each winter from tubercular inflammation of the brain or its membranes.

I do not think that tubercular meningitis in the child is as frequent in Colorado as in the Eastern cities.

ACCLIMATION OF THE CONSUMPTIVE TO THE CLIMATE OF COLORADO.

By Dr. H. O. Dodge, Boulder, Col.

In treating this subject the exact definition of the word acclimation will not be held ; for persons in health who come to this land of sunshine do not, as a rule, require any process of adaptation, or change of habits as to clothing, food, or shelter, to enable them to survive and flourish among our mountain resorts ; nor are we remote from the life-long residence of a majority of those who seek a new lease of life in the pure air that surrounds our plains and mountains.

Some, however, find it necessary to be very circumspect in taking exercise or doing severe labor at the higher regions of our mountain system until they become accustomed to the low density of the atmosphere that obtains at the higher altitudes.

To a large majority who come to Colorado there is experienced a feeling of lightness and buoyancy in all their movements when not carried beyond the point of physical endurance. The respiration and circulation are accelerated ; the chest expansion is increased ; there is a desire to draw in long, deep draughts of the invigorating air, and a feeling of strength and stimulation pervades the individual.

The ability for continuous exercise or labor can only be measured by the capacity of each person. At an altitude of 5000 or 6000 feet above the sea level a large majority can do full manual labor or take any amount of exercise, while the exception noted above is occasionally met with.

When fatigue follows exercise, the vital powers are fully restored by a short period of rest.

At or above timber-line even the most robust find it necessary to rest frequently. The strength is soon exhausted, but is as promptly restored by an interval of quiet.

The acclimation of the individual consists in overcoming these conditions of altitude and low density of atmosphere,

and in acquiring the ability to do full labor or take continuous exercise without detriment to the system.

The diminished heat at this and higher altitudes, together with the increased tissue changes consequent on the accelerated circulation and respiration, creates an increased demand for food ; hence the Coloradan, especially the mountaineer, is blessed with a keen appetite and vigorous digestion ; and while his store of adipose is usually small, his muscular powers are, as a rule, above par.

The cool nights enable every one to secure refreshing sleep, which restores any loss of vitality from mental or physical labor, and invigorates the system for new efforts.

The dryness of the atmosphere enables one to withstand changes of temperature without inconvenience, that in more humid climates would be detrimental to health, or even dangerous to life.

Many other characteristics of climate and environment might be mentioned did time permit or our pose demand.

Others have written in glowing terms of our almost constant sunshine ; the grand and awe-inspiring mountains and cañons ; the beautiful and ever-changing scenes that are constantly passing in review ; the pleasures and excitements of hunting and fishing ; the allurements of hidden wealth and the possibility of acquiring a princely fortune by some fortunate venture. These are all matters worthy of careful consideration. But above all these the new lease of life that is possible to the consumptive by a residence along the foot-hills or among the mountains of Colorado is sufficient reason for us to recommend our State to this unfortunate class as one of the most favorable spots on the continent in which to recuperate lost energies, combat the dread disease, and live out a longer measure of life. In nearly all cases of consumption which seek this climate, the effect of altitude and low density of the atmosphere will be noticed by the inability of the patient to carry on a satisfactory respiration and take any form of exercise. Even walking a short distance is impossible at first with many, and it takes longer to become accustomed to the new conditions than in health.

The effect of altitude and low density of the atmosphere on the organs of respiration and circulation must be carefully

judged of in each case, as these effects will form the basis of location of the individual, whether he will be advised to remain on the plains, along the foot-hills, or sent to the higher resorts. The acclimation of the consumptive to the climate of Colorado in the sense used here means a gradual improvement in all his symptoms as a consequence of his new surroundings.

The respirations, as in health, are increased in number each minute ; the circulation of the blood is more rapid ; the chest expansion is greater ; a larger supply of oxygen is furnished the blood, which, in turn, gives an increased vitality to the tissues. The lowered temperature and rapid tissue changes create a demand for more food, hence there is a better quality of nourishment furnished the body, though there may be no increase in weight.

As the process of acclimation goes on, the patient notices a gradual decrease of cough and expectoration. If chills, hectic and night sweat have prevailed, they shade off into a memory of one of the ills that induced a change of residence.

General vigor and desire to act take the place of lassitude and enervation, and new plans for business or pleasure are formed. This process may be slow, yet result in complete restoration to health.

CONSUMPTIVES CURED.

There is no registration or means of knowing the actual number of consumptives who come to Colorado, hence it is impossible to make an estimate of the proportion of all cases who are thus benefited. I might, however, tabulate upward of 200 cases which have come under my personal observation during the past 19 years, who have been so materially benefited as to enable them to embark in business pursuits, and begin life anew.

This aggregate of cases who become acclimated to our climate, and thereby cured, may be divided into three classes —viz :

First, a few who are absolutely cured, and who may go to any part of the world, or engage in any business and enjoy an immunity from consumption. Second, those who may go to lower and less favorable climates during certain selected sea-

sons of the year. Third, those who cannot with safety make any change of climate.

According to my own observation and recollection of cases, the first class consists of about 4 per cent; the second class, which includes the first, about 50 per cent, and the third class about 50 per cent.

I will cite two cases of the first class to illustrate the possibilities of a cure under very unfavorable conditions. One was that of a man aged 28, who came under my care in February, 1872. He had just experienced a profuse hemorrhage. There was a regular recurrence of chills, hectic and night sweats; this was the second severe hemorrhage in the history of the case, although he had expectorated blood several times. Patient was raised in Pennsylvania; had worked beyond reason in his desire to accumulate property; repeated exposure resulted in pneumonia; got up before full resolution had occurred; cold followed cold until a general prostration and hemorrhage called a halt. He was advised that his condition demanded a change of climate. There was, in addition to above symptoms, a general infiltration of the upper lobes of both lungs; in the left a large cavity, profuse expctoration of characteristic material, dyspnœa on exertion, no appetite, and rest interfered with by cough and perspiration. Vigorous measures to combat unfavorable symptoms were instituted, and an almost constant out-of-door life during the spring, summer, and autumn months was followed by a perceptible improvement. In the spring of 1873 he purchased a small business, to which he gave a part of his time, the remainder being spent in the open air.

In 1878 the last examination was made, and it was found difficult to believe that the strong, florid man before me was the one whose pale face and skeleton frame had caused so much solicitude five years before. This patient was not allowed to go into the mountains for five years, every indication being, in my opinion, such as to render a higher altitude and lower density of atmosphere not only undesirable, but absolutely dangerous. Since the date of my last examination, he has been East, South, and West, and is now engaged in business on the Pacific coast, and considers himself in perfect health.

The second case is that of a clerical gentleman who left college with failing health at the age of 23. He took a charge, but increasing prostration with partial aphonia forced him to resign. Came to Pueblo in 1879 and undertook to preach, but complete aphonia compelled him to suspend work. Came to Boulder to visit a friend, and was persuaded to stay. On examination I found general infiltration of the upper lobes of both lungs with tubercular deposit, with a chronic laryngeal and bronchial inflammation. Aphonia was complete. There was a chill between twelve and one o'clock day and night, followed by hectic. Copious perspiration was sure to follow sleep, and exhaustion was becoming more pronounced daily. There was no cavity, never had suffered from hemorrhage; cough was hoarse and of a bronchial character; expectoration free, but less profuse than in preceding case. His family history showed a sister, brother, and two aunts who had died of consumption; extreme despondency marked every look and action. The unfavorable symptoms were combatted and efforts made to assist assimilation. For fully eight months he barely held his own, after which a slow but progressive improvement began. The waxy countenance assumed a healthier hue; the emaciated form began to round out; with these changes the patient manifested an interest in himself, and hope returned; medicines were discontinued, and an outdoor life adopted.

In the spring of 1882 he travelled extensively in the mountain parks and over the range, and for the next four years roughed it in good earnest.

In 1886 I did not at first recognize a typical-looking cowboy who requested me to see if I could find any improvement in his lungs. The most careful examination failed to reveal any but the normal murmur over every part, while his general appearance emphasized his assertion that he was entirely well. He went to Philadelphia, and while there was examined by two eminent medical men, each ignorant of his past history and of the examination of the other, both of whom pronounced him sound. While on this trip he married, and is now living in Tennessee, engaged in following his chosen profession.

Cases in the second and third classes are to be met with all over the State, and need no illustration here.

There is no doubt that the percentage of acclimated cases would be much greater if consumptives would seek this climate at an earlier stage of the disease than a majority of them do. So many come to Colorado at a sacrifice of all their possessions, after every reasonable hope of even temporary relief is gone, only to perish on the threshold of the promised land, that many who are still in a condition to receive benefit are deterred from coming. I believe that many physicians of the East are not sufficiently discriminating in advising their consumptive patrons where to seek a change of climate, nor can they be familiar with the conditions that prevail at the altitude of the Rockies. If they were, the spectacle of a consumptive dying in transit from station to hotel would not be seen, nor would so many succumb during the first or second months of their sojourn in Colorado.

DISCUSSION.

Dr. Ingals: The author of the paper mentioned one point incidentally that did not correspond with what I have observed, either personally, or what my patients have observed, and that was that people coming to this high altitude sleep well. I do not know what the version of those who sleep well is, but I have known of a good many that sleep poorly. Possibly the gentleman might give us some idea what induces those to sleep who cannot sleep well, and what kind of patients can sleep and what kind cannot.

Dr. Dodge: I mention in the first part of the paper, in regard to those who come here in health, that they universally sleep well, and my experience is this class of cases who become acclimated, according to the idea of the paper, as a rule sleep well. There are many who do not sleep well, and a large number who do not in any sense become acclimated, according to the sense of this paper.

ON THE RETURN OF CURED TUBERCULAR PATIENTS FROM HIGH ALTITUDES.

By Frederick I. Knight, M.D., Boston.

Can patients in whom tubercular disease of the lungs has been arrested in high altitudes return with safety to low ones?

The brief remarks which I have to offer upon this topic were written with the hope of exciting a discussion which would bring out the rich experience of our Western members with cases of arrested pulmonary disease. It is a common saying in the East, "If you go to Colorado you must live there forever after; you can never return East."

Whence did this idea arise? Because many patients have undoubtedly suffered relapse after coming down from high altitudes. Why did they suffer relapse? (1) Some because they returned too soon, and (2) others because, though practically cured, they returned to exactly the same conditions which produced the disease in the beginning.

When a patient convalesces in a high altitude, after failure to do so in a low one, it is because he has experienced certain conditions (whether of dryness, low atmospheric pressure, or what, it is not my purpose now to discuss) which he had not encountered before.

It ought to be self-evident in this, as in any curative process, that its conditions should not be rudely interfered with before certain definite results are obtained.

Nature has begun her process of restoration on certain lines, and the attempt at readjustment to others, even though they may be in themselves equally good, must be dangerous.

"It is not safe to swap horses while crossing the stream."

In speaking of those who return from a mountain climate too soon, I will not stop to more than mention the innumerable host of patients who flit from place to place, without ever being adjusted to the conditions of any one. They come here, stay a few weeks, find that they cough more (per-

haps this may be the beginning of a beneficent change in the lung), get discouraged, and go on to some other climate without taking professional advice, or, at any rate, without heeding it, if sought.

These patients need that staying power which is so necessary for recovery from such a formidable disease, innumerable instances of which will occur to the minds of every one here present. It is that which keeps them courageous through the almost inevitable set-backs which occur in the progress of the disease. It is that which all experienced practitioners recognize at once in a patient as one of their most powerful allies, and the absence of which weighs heavily on the adverse side in the consideration of prognosis.

There are others, however, who stay in the mountain climate long enough to experience marked benefit from it, who tear themselves away too soon, before the disease is sufficiently quiescent to bear transplantation. The shock may be hardly less than that to a delicate plant moved from one soil to another at an improper season.

It is difficult to bring such a matter as this down to an exact numerical basis ; but it may be said, as a rule, I think, that all patients who have experienced an arrest of pulmonary tuberculosis in high altitudes should stay in them at least a year after the arrest may be fairly said to have been established.

What patients in this case can be allowed properly to go to their homes, and what ones should be kept from them, will be considered shortly ; but, in the first place, let us for a moment consider what may be called an arrest of the disease. In general one may say that an arrest of the disease has taken place when all morbid general symptoms have been absent for a period of from six months to a year, with the following exceptions : A little morning cough with expectoration may remain for an indefinite time after the arrest of disease. The weight may be somewhat less than at a lower altitude, the pulse may be more easily accelerated, and, of course, some dyspnœa on exertion may remain, in proportion to the lung area originally involved. Locally, on physical exploration, one will continue to obtain some abnormal signs, except in cases in which the amount of disease was originally very slight. These are

usually signs of contracted, partially consolidated lung-tissue, with some rather sparse crumpling rales, but not an extensive area of moist bubbling. With these exceptions the patient is well ; feels well, and asks to go home. Whether he should be allowed to go back to a low altitude depends in great measure on how far he will put himself into the same conditions under which the disease originated, and how far he may be able to modify them.

In regions where tubercular disease is prevalent every one is constantly exposed to its reception. That most persons escape it is due to their predominant power of resistance. When any factor which helps to make up this power of resistance fails, or when the infecting agent is suddenly increased in quantity, then the disease is more liable to become implanted. Now, in some cases it will be not difficult to determine what change took place in a patient or his surroundings to produce the disease, and if this can be determined with tolerable certainty, and is found to be such as can be avoided in the future, then we can with more confidence allow him to return.

Those who show a strong hereditary tendency to the disease—in other words, who afford a favorable soil for its growth, no matter how unusual the exciting cause may have been—had better be encouraged to remain in the climate where arrest has taken place, except for such occasional temporary changes as their general condition may seem to indicate. Those having this receptive soil are so extremely liable to fall prey to the disease that any influence which has proved itself beneficent had better be maintained. On the other hand, if the patient has no inherent tendency to this form of disease in himself, but has been the victim, as it were, of external causes, he may be allowed to try a return under different conditions.

CHANGES BENEFICIAL.

What conditions, under which the patient lived when the disease was contracted, can be altered for the better on his return ? In the first place, his residence may have been dark, damp, and on a clayey soil ; this may be changed to one on a dry, sandy soil, and one filled with sunshine. The profession to-day fully endorses the claims of Drs. Bowditch and

Buchanan in regard to the effect of soil-moisture in the production of tuberculosis.

In the next place, his occupation may perhaps be radically changed from an in-door one, necessitating the rebreathing of a vitiated air, laden not only with carbonic acid, but perhaps with other noxious agents, to one which will keep him outdoors the greater part of the day.

Again, if pains were taken to trace back the beginning of cases of tuberculosis we would be often surprised to find how many of them could be reasonably attributed to improper or insufficient diet. Man has not yet been inclined to bestow that care on himself in regard to the quality and quantity of his food, which he has long since been accustomed to bestow on the lower animals. In the case of the animal, man recognizes the economical necessity of bringing him to the highest possible degree of strength. In his own case he tries, by cunning in various ways, to diminish the amount of physical work required of him rather than to give himself the strength to endure it. He shows a total disregard, and usually ignorance of the simplest rules of dietetic hygiene. Sometimes he is aroused to the importance of the subject only to commit himself to some very unsuitable and injurious bill of fare—*e.g.*, an exclusively vegetable diet after a lifelong of meat-eating.

I cannot help thinking that a much greater influence in the production of disease is exerted by the food with which we furnish our bodies than we are accustomed to admit, and that much more is yet to be accomplished for our welfare by its proper management. At present the usual preparation of food is so bad that, after we have found out what nutriment a patient's condition requires, it is well-nigh impossible to secure it to him. I am happy to say, however, that this subject is at present beginning to attract serious attention, and that something like suitable schools of instruction are being established. I hope to see before long schools for cooks established in every large city, where women shall be thoroughly trained in all branches of cooking, and furnished with a diploma when competent. There should be established, in connection with such a school, a bureau of registration, where the subsequent history of each graduate shall be kept on file, available for reference, as in the case of nurses. While I

believe that such a systematic method of instruction can be successfully employed in the case of other servants, I think that the best cooking will be taught in schools devoted exclusively to that, rather than in the schools for general housework which are now being established. I have dwelt upon this point because I believe there are few families whose average health is not below what it would be with properly prepared food. So, then, by special effort in improving his diet, a decided change may be made for the better in the prospect of continued health of a patient with arrested tuberculosis.

There are also some cases in which mental depression from surrounding conditions is such as to render it fairly liable to the accusation of causing the disease. This may be capable of radical relief.

There may have been some accidental change in the lung, which will make it more liable to infection, which with care we may hope to avoid in the future. This applies, among other things, to inflammatory conditions, to which some are exceedingly prone, while they seldom occur in others. A good illustration of permanent arrest of tubercular disease, perhaps coming under this class of cases, is afforded by a gentleman who consulted me in July, 1876. He was then 29 years of age. His mother had died at 33 of pulmonary tuberculosis, when the patient was two years old. He had never had serious sickness, and was not prone to inflammatory conditions of the air-passages. A year before he had strained his chest, and since then it had not felt quite right. He attributed his symptoms, for which he consulted me, to exposure as a member of a military company which took part at the opening of the Centennial Exhibition the previous May.

He complained of cough, loss of flesh and strength, dyspnœa on exertion, and night-sweats. His pulse was 84. There were signs of partial consolidation and moist rales in the upper lobe of the right lung. I find no record of the temperature in my notes. I advised him to spend the remainder of the summer at Block Island, and if his cough still remained in the autumn, to go to Colorado. I saw him August 29th. He had gained flesh and strength, and the night-sweats had ceased. His pulse was 66. His cough was

worse in the morning, but less in the day. The signs in the chest were less marked, but still evident. I advised Colorado. September 7th the night-sweating returned. He left some time during this month for this State, and I did not see him again till the 19th of the following May, when he presented himself in my office. He returned, I presume, without advice. He stated that after reaching Colorado there was not much change till November 1st; then he began to improve, and cough and expectoration ceased entirely by the 12th of November. He stayed mostly in Denver up to that time, and afterward camped out, and was on the prairies most of the time. He took very little whiskey, but 5 to 15 glases of beer daily. He started for home on business April 23d. He began to cough as soon as he got east of Kansas, but was not conscious of taking cold. He had gained 22 pounds in weight. He now had morning cough and expectoration, and some cough after meals. His pulse was 78, and temperature 99 degrees. On examination of the chest there was marked improvement, the only morbid signs being prolonged expiration at the right apex, with slight dulness; and on deep inspiration a few clicking rales in right front from top to nipple. Nothing like moist sounds were heard anywhere. I advised him to go back to Colorado, and to stay there. This he did, and remained till March, 1881 (about four years), with only one visit East during that time. Since 1881 he has remained in Boston. Exactly when his cough and other symptoms again disappeared I do not know; but since his return he has never had cough or any other suggestion of pulmonary disease. There was admitted to have been a pretty free admixture of Eastern whiskey with Colorado air in the therapeutics of the latter sojourn in the West. Just what the determining factor in this tubercular invasion was, whether the strain, or the acute cold from exposure, or both combined, is not perfectly clear; but inasmuch as the patient's life in general has since been much the same as before the attack, it seems proper to consider the cause as something exceptional. He came home and remained there on his own responsibility. Considering his hereditary tendency, I should certainly have advised him to stay away from the Atlantic seaboard if I had been consulted.

Finally, the determining factor in the production of the disease may have been exposure to such a quantity of infecting material as could be avoided in the future, if the patient returned home. For instance, such a condition as was reported recently in a counting-house in Paris, where a very large proportion of the clerks had become tubercular, and expectorated upon wooden floors, the sweeping of which was completed in the morning, after the clerks began to arrive.

I have introduced this topic because I feel sure that patients cured in Colorado need not all remain there ; and because I feel that it is very important that they should take competent advice in regard to any desired change, and also that the physician, in case he should allow any to return, should make well-directed effort to diminish the liability to a recurrence of their disease.

DISCUSSION.

Dr. Solly: I was delighted to hear Dr. Knight's view of this subject, which is founded on considerable experience. It is the view I would expect him to take, because it is a reasonable one; it is exactly similar to the one I have formed myself, and the statistics which I offered the other day I think will show the same thing, how those cases of the character described by Dr. Knight can go and remain East and others that have to remain here.

A thing I might perhaps add is, that my experience is rather pointed out by what Dr. Leonard Weber and other observers in the Alps seem to think, that persons who are cured in high altitudes stand a better chance from further attacks and a better ability to grapple with life at home, wherever it may be, than a cure in a more humid climate; and physiological reasoning would bear out that method, because the heart muscle is more strengthened. And in those who have a tendency toward weakness, which is common in many consumptives, that danger is eliminated in the future, for the reason that in cases of consumption, as Dr. Knight points out, there are those who may be said to have a natural tendency to consumption and those in whom it is accidental; and in arriving at actual conclusions on the subject, it takes a great number of cases.

I certainly think we must combat the idea that a cure in Colorado is less a cure than elsewhere. I think it has a tendency to be more.

Dr. Bowditch: Dr. Knight's most valuable paper strikes at a most vital point, I think, especially for us Eastern physicians. Nobody realizes so much as the Eastern physician, I think, the hard work that is to be done in telling a patient that he must go away for trouble in the lungs, in the first place, and more than that, to tell him he never should return even if he recovers from the disease in a more favorable climate.

I confess that my teachings from my earliest medical days, from my father, have been decidedly against the idea of patients returning to Eastern climates if they have recovered in another climate. He said to me just before I left home, "I am very much interested in this question that Dr. Knight is going to speak about, and I am very desirous of hearing what he has to say, and I only wish that I could be there." But he said, "Say for me that my experience has been thus far, that if a patient goes away and recovers he must stay there, because I have had so many cases that have returned apparently perfectly well, and after a residence of a few months in their old home the trouble has returned, and they have gone literally to the ground."

My own experience has not been sufficiently extended to enable me to speak in positive terms upon this question. I can recall several cases where people have gone away and have returned, and have now been residing in Boston or in that vicinity for at least six or seven years and are in perfect health.

Certainly Dr. Knight's experience is most valuable to us, and I think the profession cannot be grateful enough for his excellent paper.

It seems to me that it all points toward this one fact—the fact that more patients can come back than used to in former days; that for some reason or other consumption is no longer the fatal disease it was considered a generation ago, and certainly all we can hope for is to do as Dr. Knight suggests, telling the patient if he does return at some future time, with the lungs healed, he must not take up the life that he formerly led at his home.

Dr. Fisk: Dr. Knight's paper has been one of special interest to me. It is a paper that is of very vital importance to all the physicians in Colorado, more especially those having patients from the East. It presents a subject we have had under consideration for some time—viz., the advisibility of letting patients go back East, not only for a permanent residence, but temporarily on visits. It is very hard for most consumptives to come to Colorado. They are apt to be persons of pushing, energetic temperaments, who have broken down in consequence of overwork and enthusiasm; they leave interests behind which pull very hard indeed, and their hope

is, on coming here, that after a few months they will be able to go back again to their old lines of occupation. They are frequently not undeceived in reference to this on coming here; they are told, perhaps very properly, to go out to Colorado to see what it will do for them, and then it is left for the physician in Colorado to gradually break the news, that they must stay here a greater or less length of time. It has been our boast that Colorado furnished opportunities for persons who had obtained an arrest of trouble, so that they would find fields into which they could throw their energies, as they did East, and having gained and recovered, or obtained an arrest of the trouble, they could live here as men and women, bearing their share in the burden of life. Colorado being a new State, and the avenues still open for all sorts of enterprises, it offers every opportunity to persons who are anxious to work, when they are able to get into such a position. Nevertheless, there are those, strange as it may seem, who, even after a residence of a few years in Colorado, are desirous of returning to old associations and old locations, and the question comes up as to what class of cases we can send back.

Experience in the past has not been very favorable to our sending patients back to the East again. Whether they have been imprudent, and, like a schoolboy turned out on a vacation, have committed some imprudence, some excess, and have brought on a relapse or not, is pretty hard to say; but a great many cases have gone back from here that have not done well, and have returned to Colorado, going only from bad to worse. Our experience has also shown that where relapses occur the patients do not pick up so rapidly a second time. So we have been very cautious with reference to giving any advice about our patients going back again. A number of years ago this even extended so far that we did not allow them to go back on vacations; the idea was one of a permanent residence in high altitudes. That stringency has given way in the minds of the profession, and we are now letting a certain class of cases go back for a vacation nearly every year.

Now the question arises as to the proper season of the year in which to let such patients go back, where there has not been a total, but a partial arrest of the disease, where the case is getting on well, the nutrition and recuperative power

good, and no risk of catching cold. For my own practice, I consider the month of September and early part of October the best season in which to permit them to go East. It is the part of the year which I have selected myself for my own trips, but for the last three years I have found that the Atlantic Coast, Massachusetts, and New York were so damp and rainy that I have about given up the idea that October was a good month, even in the East. I know that in 1888, in Western Massachusetts, there were eleven inches of rainfall in September. Of course that is not a good time, if it is common, or anything like that. It is not safe for a consumptive to go from a dry climate to such moisture. Trips back do our patients a great deal of good if they are cautious—if they will keep regular hours and do not dine out too much or go to the theatre. In other words, if they use considerable caution, the change from a high altitude to a low altitude, the change of scenery and the mental change benefits them. When they come back, as a rule, they do better.

Now, in reference to a permanent change, I think that in Colorado most patients who have obtained an arrest of phthisis do well to stay here. We are now very cautious in any case about advising them to go back for a permanent residence. Of late years, in my own experience, some patients have gone back, and I am pleased to say I have in mind now not very many, but some half dozen perhaps, who have gone back that are carrying on the burdens of life in the East; two men I have in mind being doctors, and they are doing remarkably well. And these few cases that are being selected with an especial care lend hope that the avenue will be open after awhile to more going back.

There is one thing which, in my mind at present, is an obstacle and a barrier to a patient's going back, and that is where there is a strong hereditary taint, as in a case where I was consulted recently, in a young man who never had any pronounced trouble in his chest, but lost two brothers from pulmonary trouble; he lives upon a ranch and has perfect breathing apparatus, as far as I can determine. He is anxious to go back to friends and business matters East, but inasmuch as there is this tendency in his family, I have advised against it, and my advice has been corroborated by that of others.

Dr. Rogers: In my experience, the cases in which there is the greatest objection to going back are those that have a tendency to hemorrhage. Wherever there has been the slightest tendency to hemorrhage, though the lungs heal completely, in my own practice I am very slow to allow them to return to a lower altitude.

I heard only yesterday of a young man's death who had been out here in a bank and had returned to Ontario. He returned and was well, but had not been at home six weeks before his old trouble returned, together with the same class of hemorrhages he had had before, and his death followed very rapidly.

As a side question to this, I think the Eastern physicians should always, when they send a patient to Colorado, tell him as soon as he arrives here to place himself in the hands of some competent medical man, and not to return until that man says he is in a condition to do so. Until he knows that the disease is thoroughly over he certainly cannot return with safety. Patients come out ; they may or may not consult a doctor as soon as they get here. When they do, they often improve so rapidly that they think they are safe to return under any circumstances, and they often do return without consulting the physician, and in consequence often return too soon. No medical man residing at sea-level can properly advise a patient when he has come to the changed conditions of a mountain climate.

The point of the tendency to hemorrhages is the point of which I wished to speak particularly.

Dr. Eskridge: It seems to me that the subject treated of by Dr. Knight is of so much importance we should not let it go by without discussing it at great length. It is a subject that interests every one of us who comes to Colorado for health. I would like to know from him or others who are able to give any information on the subject whether they have in their experience seen any consumptive coming to Colorado, where there has been broken-down lung tissue—a cavity—who has been able to return East and live permanently there.

I was sent here six years ago with a cavity in the right lung and tubercular infiltration in the left, the right lung being entirely infiltrated at the time. I gained twenty-two pounds

the first two months. I kept on gaining until I gained fifty pounds. I returned in 1887, and Professor Da Costa said he could find nothing except a slight contraction on the right side of the chest ; but when I returned to him two days later he told me that numerous moist rales were present throughout the right lung, and advised me to leave for Colorado at once. I remained two weeks, and in those two weeks I lost just ten pounds ; my expectoration returned, which I did not get rid of till six or eight months later.

I have known of a number who have come to Colorado quite sick, without any breaking down of the lung tissue, who apparently were able to go back and live for periods of many years in the East ; how long they will be able to live I do not know.

I think Dr. Bowditch the elder is right in the general statement, that all patients who come to Colorado and improve, and find the climate congenial to their condition, should not return. This should be the general advice, I think, to every patient, or to the majority of patients ; but there are undoubtedly exceptional cases that seem to be able to return. But it seems to me of the utmost importance that both the Eastern and Western physicians who pay special attention to lung diseases should be careful to discriminate those cases that are permanently able to live East, whether it is a hemorrhagic case or one of any other character that can possibly return East and live there permanently, because it is a great mistake, and a mistake that can never be repaired if it is once made. If a man does return East and breaks down, as Dr. Fisk has just stated, and Dr. Solly corroborated him, with lung trouble, he rarely ever recuperates as well in Colorado as he did the first time. To reiterate, I will say it is of the utmost importance that the physician paying special attention to lung disease should be able to discriminate and tell as nearly as possible which class of cases may go East to live after regaining their health in Colorado.

Dr. Solly: The point with reference to that is an experimental one. When you think it is safe to send your patient East, let him go for a short time, and the duration of the visit is one of the most important things. For instance, there are a very few cases that should remain here less than a year to

begin with ; it is a good rule to start with, and then let them go East on a short visit of one month's absence entirely from Colorado—I mean the whole length of time being one month —that is another good rule. Our experience with patients visiting the East is this : The first three or four weeks does them a great deal of good ; they have the stimulus of seeing their friends, and better food, and change of scene, and all the pleasure and the profit that comes to them of the change. After the first three or four weeks they begin to cough a little and begin to decline ; they don't pay much attention to it, and they go on until they get into serious trouble again. The difference between one month and six weeks' absence is in many cases remarkable. When they come back the next year extend the time to six weeks or two months, if they have had no bad effect from it ; and so, by experiment as well as theory, arrive at what your patient can stand. But the great thing to impress upon those patients is to obey strictly the limits you give them. I nearly always find if you give them an inch they take an ell ; that is frequently the trouble in patients going East. If they obey the strict letter of your injunctions and limit themselves to the very day you tell them to return, you will generally find they will benefit, even within the short limits I suggest with experimental sending East.

Dr. Fisk : We have with us one of the older residents of Colorado, who has had very large experience with reference to the subject now under discussion, and I would like to call on Dr. Bancroft.

Dr. Bancroft : Mr. President and gentlemen, I did not come expecting to make any remarks, and what I say will be mostly from memory. The most notable case that I ever knew of recovering from lung disease was acquired from a gentleman who lived in St. Louis—I have forgotten his name. He came out onto the plains at the age of twenty-three years with a hemorrhage, expectoration, night sweats, etc. He returned to St. Louis, and after a period of fifty-five years he made a visit to Denver ; he was then in his seventy-seventh year, and had been an active business man. The question which perplexes the physicians of Colorado mostly is this, that a patient remaining here for a year or two is anxious to return

to his home for the purpose of making a visit—when shall they go East and how long shall they remain? It has been my experience that in many cases after a residence of one or two years here they gain rapidly for two weeks in the East, often picking up in flesh rapidly, and they have to be charged that, notwithstanding the temporary improvement which they find in the East, they should return, and not remain until the tide turns the other way. I have known many who have returned East and remained and enjoyed good health. Some who seemed to lose rapidly here have gone East into a damp, moist climate by the seaside, have regained their health, and are still living after ten or fifteen years.

Another question sometimes has suggested itself to me. It has been my observation in years past that many of the wives of consumptives come here affected with the disease which their husbands have had. I remember one instance of four men coming here, all of them with strong and apparently healthy wives, and all of these wives within one or two years were affected with phthisis. In such cases, where there is a very long standing phthisis, would it not be advisable to insist upon the families of such consumptives to remain a year or two? I think it would be advisable. I have no doubt others have had the same experience, that the wives of consumptives very frequently return with the same trouble.

Dr. Pitner: I wish to speak a word on the question as to the best time for the returning of phthisical patients to the East. I live in Central Illinois, and the most healthful months of the year are May and June; we have the least mortality throughout the State in those months. Our phthisical patients improve more during the months of May and June than any other time of year, so it occurs to me that it is decidedly the most advisable time for patients to revisit the East. They are not subjected to the severe heat of the summer or to the autumnal changes from rains. We have rains in September and October and changes which are unfavorable. In May and June there is little rain and more equable temperature, and the climatic conditions are more favorable, it seems to me, than any other period of the year. From the middle of May to the middle of June is the best time in the year.

Dr. Rogers: A case has just come to my mind that bears

on the point and may be of interest. A gentleman of education came here this year from Davos. He had resided there for five years. He was sent there from London upon the advice of three or four most prominent physicians. They held out to him only the faintest hope that he could even get there alive. He said he was now one of the show cases of Davos. I asked him, "Why have you done so much better than other patients?" and he said, "Simply because for five years I have never gone down from the altitude of Davos, although for two years they have considered me sound; I have only come down now to come at once to the same altitude in Colorado. I am convinced of the fact that the great secret of the high altitude treatment is a permanent residence in the high altitude. I never want to go down to sea-level again except on such a trip as I have just made of necessity." For two years he has been practically sound. In examining his lungs, I could hardly tell which lung had been the bad one. He is living here now, and is quite satisfied to make this altitude his home for the rest of his life. He says, "The reason the cases do not fare so well in Davos as in Colorado is because it is the rule of the people to go down from there during the summer, when the snows are melting. It is a great deal better to stay there, though the snows are melting, than to incur the danger of going down to a lower altitude and later going up again."

Dr. Denison: For my present purpose, with reference to Dr. Knight's paper, I consider this evidence, as coming from a physician in whom we all have implicit confidence, and one who does not live in Colorado, as of special importance. The prejudice, which I am sorry to say naturally creeps in with reference to the evidence of a man who does live here, cannot apply, and this fact makes the paper of Dr. Johnson, to follow, one of the most valuable records we could have. To my mind, there is nothing to compare with this list of cases.

Let us go over it in a cursory way. As to the cases that did not improve, I think there is a mistake in one, as you will see. In the first list that did not improve the time they were under observation was only five months; that will show you why number four is perhaps cut off from being in another class. The second class which were improved, but not cured

were under observation one year. The third class that were cured were under observation seven years, which is a valuable fact, because that was a long enough time to have the author sure that they were improved. Let us take the seven cases that were not improved, letting the others stand for themselves, and nearly all in the last class were those that went into the high altitude, all of them, I think; and some of them were advanced and had excavation in the apex. Of those seven cases, number four was a case of laryngeal phthisis, and was four months in Colorado; then after he went home he was worse, and he being under observation an average of five months, he goes into the unimproved class. But what happened afterward? After his return East he was worse. Went again to Denver for ten years, and on return began to cough again. A third time he went to Denver, and while he was there he was well; the last time he was heard from he was in the West. That record is added afterward.

Number eight, the next case. He had improved while he was in the West, but five years after he was worse, out in Santa Barbara. The fact that he had gotten worse in a low altitude ought to be remembered with reference to that case.

Number twelve, the next one, died in Los Angeles in four months.

Fifteen, the next one, is somewhat doubtful, because he was in Colorado when last heard from, though the author claims this patient might be one of the cranky ones; he wasn't getting well, yet he was in a fair condition. The doctor remarks he might be mistaken in his own estimate of his case.

In number seventeen, the next one, both lungs were affected, and there was a long delay after that fact was found out before he went West. Such a case naturally might not improve.

Eighteen. Nine months in Denver; thought that he had improved; went back East and died in Chicago.

Twenty-one. Went first to California, and the doctor says in his record that he had no cavity. He had a cavity, however, when he, in two months, returned to Denver. He died in Chicago. I think that is a fair estimate of those cases, and very creditable, so far as Colorado climate is concerned.

I wish to say just a word with reference to Dr. Knight's question that was proposed this morning. As a case I was

examining a few days ago seemed to my mind to bear upon the question, I picked up the record and brought it along. It seems to me that a great many of these patients that go back East and retrograde have themselves to blame for it, and, as Dr. Johnson says, when they once return they do not get the same benefit the second time going West. That the tubercular condition does not do so well on the second visit is generally borne out with my cases.

I would like to read this case, and then say a few words with reference to some that are similar.

August 18th, 1890, , 34 ; married ; eleven years from Canada ; photographer. No inheritance. He had right pleurisy before he was married. Six years ago caught a bad cold, and for six months had inflammation in right lung, night sweats, and afternoon hectic. Was up and down after this. Came to Colorado five years ago, and felt elevation ; weight then 130 pounds ; in health it had been 145 ; now it is 125. At the same time he came he improved and gained 20 pounds in Colorado in six months. Went East and caught cold and lost his 20 pounds. Came back after four months ; was bad off ; did not gain as before ; was raising, and has been ever since. Now he expectorates half a pint in twenty-four hours of yellowish matter ; no night sweats now ; no hemorrhage ; bowels not regular ; better, perhaps, lately ; diarrhœa at times ; skin sallow ; vomits after meals ; will vomit at night if he lies on left side ; feverish in afternoon and chilled mornings ; working in photograph gallery, or has been so, three years ; stooping over makes him cough ; right ankle has been swelling of late ; finger ends somewhat clubbed ; pulse, 96 ; respiration, 24 ; temperature, 100° ; spirometrical record, 80 cubic inches ; height, 5 feet 10 ; expansion 32 and 33½ ; movement more on left, but dulness in both apices in front. A peculiar thing about him, a year ago last May he said he stooped over after pumping water, and he thought he must have emptied as much as half a pint of matter from his mouth. Evidently he emptied a cavity at that time. No succession, but deep-seated hollow sound on stethoscopic percussion in right interscapular region ; no vesicular murmur heard on right ; right base dull and mucous rales in front. Cavernous voice and bronchial wheezing on cough, in large space,

right interscapular showing excavation, or large bronchiectasis. Left—bronchial breathing and fibrosis ; expiration, 6 ; inspiration, 4. Right—expiration, 5 ; inspiration, 4. Diagnosis : Chronic fibrosis and bronchitis, third right and first left, with emphysema and bronchiæ right.

We now see this case in a pitiable condition, but he has lived all this time here simply prolonging his life. If he had not gone East, there is no telling but what he would be as well as a good many of the rest of us who followed a different plan. I find many patients decide their futures themselves, no matter what they are advised by the doctors. They take their own course any way. If I was asked to decide with reference to the cases which could return East, I think I would say, if it is a hopeless case, then it is all right for them to go, but if it is like the case Dr. Knight and I have seen to-day, they can do as they please, for where there is excavation on both sides, the question of going or staying is usually not of importance enough for them to go contrary to their own wishes. Remaining simply prolongs their life or shortens it, as the case may be. But in cases of excavation in one lung, where an arrest is taking place, I should say they should not return to as low a level as where they contracted their disease. Nevertheless, I can instance a lady who lives in Grand Rapids who had remained here three years, after I first came here seventeen years ago, and she is living in Michigan, apparently well, and is quite fleshy, and there was an excavation in the left infraclavicular space nearly as large as a hen's egg when she left here ; but that is a very exceptional case. She had excellent care, and the disease was arrested. It was not progressive the last year or year and a half that she was in Colorado. Less advanced cases which have been arrested, it seems to me, ought to remain as long, or longer, after they have gone to live in a high altitude as they were in getting into their condition beforehand. The idea of coming out here and expecting to get permanent improvement in three, six, or eight months in a serious case, it seems to me, is questionable—that is, where there is a deep-seated disease or tubercular infection. However, in simple chronic pneumonias and hemorrhagic infractions, a short stay will often do wonders.

Dr. Baker : I would like to say a word on the time when it

would be best to have the patient return, if he returns. The point I wish to make is this: We have before us the results of the experience in some of the Eastern States, and I have presented here the facts relative to Michigan, and we have found there are the least deaths there in August. This is the experience of nine years. Michigan, I suppose, will not be considered the Far East, but might be considered an average Eastern district. Now by reference to this diagram of consumptive deaths in Colorado, the least deaths here occur in July, and by August there has been a very considerable increase, and by September nearly half the maximum. Apparently, then, if the patient could leave here by the time the conditions in Colorado are rapidly getting worse, he could reach the East at a time when the conditions there are favorable.

Dr. Knight: I will simply reply to a few of the questions which were put rather to me than the association generally.

The first one in regard to hemorrhage was put, I think, by Dr. Rogers. The fact which he stated, that certain patients who had a tendency to hemorrhage were apt to have a recurrence of it on a return from a high to a low altitude, was confirmed by the patient whom we saw this morning. She stated to me she would like very much to go down to Southern California, where she had been several times, and where she had gained strength and grown fat, etc., on a visit, but that she didn't dare to do it, because every time her visit had been ended by a very considerable hemorrhage.

One gentleman, I think Dr. Eskridge, asked me if I had ever seen a patient who had recovered after having had cavities sufficiently to return and live well in the East. I should reply to that in the negative, because, in the first place, I never wait long enough to allow my patients to have cavities before I send them here, and in the next place I think the tendency has been with physicians in our region to keep those patients away, where they have known of other recoveries; so I must say that all of the patients who have recovered in this region, or any high altitude, I have known them only in the early or incipient stages.

To your question in regard to a temporary return, I have selected the months of July and August, because patients then

are less subject to cold and moisture, which, as I said in regard to the mucous membranes, seem to be a bad combination. Of course that is our hot season, but there are places in New England, particularly in the White Mountains, up at Giddings, and other places which are equally well situated and which are sufficiently cool to prevent the loss of strength, that would happen, perhaps, if they stayed down in the lower region.

TRANSACTIONS OF THE SEVENTH ANNUAL MEETING OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION, HELD AT DENVER, COL., SEPTEMBER, 1890.

RELATIONS OF CERTAIN METEOROLOGICAL CONDITIONS TO DISEASES OF THE LUNGS AND AIR-PASSAGES IN COLORADO.

By Henry B. Baker, A.M., M.D., Lansing, Mich.

It is probably known to most of the members of this Association that in preceding papers, before this Association and elsewhere, I have presented extensive statistics of sickness and of mortality which proved conclusively, to my mind, that certain meteorological conditions are related closely and casually to all the important ordinary diseases of the lungs and air-passages in certain parts of the world—in Michigan, in Massachusetts, in London, England, in India, etc. The evidence is of such a character as to lead me to think that similar causal relations prevail throughout the world. But this has not yet been demonstrated. The purpose of this paper is to extend the evidence on this subject by the presentation of facts bearing upon it, collected here in Colorado, and in a few other parts of the world, where the subject has not heretofore been studied in a scientific manner, or, at least, not conclusively.

It may seem presumptuous for me to attempt to do this for Colorado, when there are so many able physicians in Colorado who are especially interested in climatology and in diseases of the lungs and air-passages; but, after having waited some years for some one of these able men to collect and publish such facts, my interest and curiosity to know the facts have overcome my modesty, and I have recently made a vigorous effort to obtain and group the facts for study. A large number of physicians, health officers, and officers in charge of public institutions in Colorado were written to, blank forms were sent to them, and an effort was made to obtain, from them and from published records, statements of the month of death of all decedents in Colorado, from consumption and other

diseases of the lungs and air-passages. I have to thank D. C. Dudley, writing for John E. Ray, Superintendent of the Colorado School for the Deaf and the Blind, and Joseph A. Lamping, Warden of Colorado State Penitentiary, for prompt responses to my requests; also Charles Ambrook, M.D., of Boulder, and T. G. Horn, M.D., of Colorado Springs, for valuable statistics of deaths in Colorado. I am indebted to the Health Commissioner of Denver for a statement of the deaths from consumption during each month of the year 1889; also to the United States Census of 1870 for a statement of the deaths from consumption in Colorado during each month of the census year 1870. I regret that the United States Census for 1880 does not state such facts relative to Colorado, or any city in Colorado. I am indebted to Sergeant Gilligen, of the United States Signal Service, now stationed in Denver, for data relative to wind and rainfall.

The statistics of deaths in Colorado from diseases of the lungs and air-passages other than consumption are so meagre that I have not been able to learn much from them. The statistics of deaths from consumption which I have collected and now present to you are not as numerous as wished, but they are valuable and quite worthy of study. It is to be hoped, however, that the public-spirited physicians in Colorado will see to it that such important facts as those relating to vital statistics in Colorado will not be so much neglected as they have been heretofore. People all over the world look to Colorado for such facts. It is gratifying to note that the city of Denver now publishes a monthly statement of the causes of deaths in Denver.

In order best to study the statistics of consumption in Colorado, and the relations of consumption to atmospheric conditions, I have put the evidence in tables, and in graphic diagrams accurately drawn to scale and correctly representing the facts in the tables. Tables 1, 2, and 3, and Diagrams 1, 2, and 3 exhibit the deaths from consumption in Colorado by months; and, by months, the relation which the consumption mortality sustains to the atmospheric temperature, the absolute humidity, and the relative humidity.

It requires only a glance at Diagram No. 1 to prove that in Colorado, as in all other parts of the world thus far studied,

CONSUMPTION AND TEMPERATURE IN COLORADO.

TABLE I.—Exhibiting by months (each made 30 days) for the years 1870 and 1875–89, the average number of deaths from consumption* in Colorado, also the average atmospheric temperature† for the 16 years, 1872–87, in Denver, Colorado.

YEARS AND MONTHS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average number of deaths from Consumption* in Colorado by months (each made 30 days) 1870 and 1875–89	44·52	41·33	35·81	41·00	40·65	29·00	25·16	32·00	31·00	39·68	42·00	41·61
Average number of Deaths from Consumption in Colorado (months unequal), 1870 and 1875–89	46	39	37	41	42	29	26	34	31	41	42	43
Average number of Deaths from Consumption in Colorado Springs, 1875–89 (months unequal)	10	4	7	6	10	8	3	4	10	6	6	4
Average number of Deaths from Consumption, Boulder, 1881–89 (months unequal)	4	3	3	1	3	2	2	4	3	1	0	3
Number of Deaths from Consumption in Denver, 1889 (months unequal)	28	31	20	32	28	14	18	25	17	34	34	31
Number of Deaths from Consumption in Colorado, in 1870, U. S. Census, 1870 (months unequal)	4	1	7	2	1	5	3	1	1	0	2	5
Average Atmospheric Temperature† in Colorado, 16 years, 1872–87	27·3	32·2	37·9	46·5	57·2	67·2	72·4	70·4	61·3	50·1	37·6	30·5

* Deaths from consumption in Colorado during the census year 1870, in Denver during 1889, in Colorado Springs and in Boulder for a long series of years.
† From reports of the Chief Signal Officer, United States.
NOTE.—The first and seventh lines in Table 1 are graphically represented in Diagram 1.

CONSUMPTION AND ABSOLUTE HUMIDITY IN COLORADO.

TABLE 2.—Exhibiting by months (each made 30 days), for a series of years, the average number of deaths from consumption* in Colorado, also the average absolute humidity† (grains of vapor in a cubic foot of air) for a series of years, in Denver, Colorado.

MONTHS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Deaths from Consumption*	44·52	41·33	35·81	41·00	40·65	29·00	25·16	32·90	31·00	39·68	42·00	41·61
Average absolute humidity†	0·96	1·17	1·43	1·81	2·55	3·41	4·09	4·08	2·77	1·96	1·41	1·12

NOTE.—Table 2 is graphically represented in Diagram 2.

CONSUMPTION AND RELATIVE HUMIDITY IN COLORADO.

TABLE 3.—Exhibiting by months (each made 30 days) for a series of years, the average number of deaths from consumption* in Colorado, also the average relative humidity‡ of the atmosphere (per cent of saturation) at Denver, Colorado.

MONTHS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Deaths from Consumption*	44·52	41·33	35·81	41·00	40·65	29·00	25·16	32·90	31·00	39·68	42·00	41·61
Average relative humidity‡	55·0	54·9	49·9	50·1	49·1	47·4	48·4	50·7	46·5	48·3	53·1	56·3

* Deaths from consumption in Colorado during the census year 1870, in Denver during 1889, in Colorado Springs and in Boulder for a long series of years.
† From reports of the Chief Signal Officer, United States.
‡ Computed from average temperature and average relative humidity by Table X., page 1393, "Smithsonian Meteorological and Physical Tables," 1859.
NOTE.—Table 3 is graphically represented in Diagram 3.

CONSUMPTION AND TEMPERATURE IN THIRTY-ONE CITIES IN THE UNITED STATES.

TABLE 4.—Exhibiting by months (all made 30 days) the number of deaths from consumption* in 31 cities in the United States during the census year 1880, also the average atmospheric temperature† at six stations.

MONTHS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Deaths from Consumption*...	1691·61	1846·58	1897·74	1821·	1657·74	1420·	1486·45	1382·90	1529·	1587·10	1595·	1683·87
Average atmospheric temperature†...	36	38	45	54	66	74	78	76	69	56	46	38

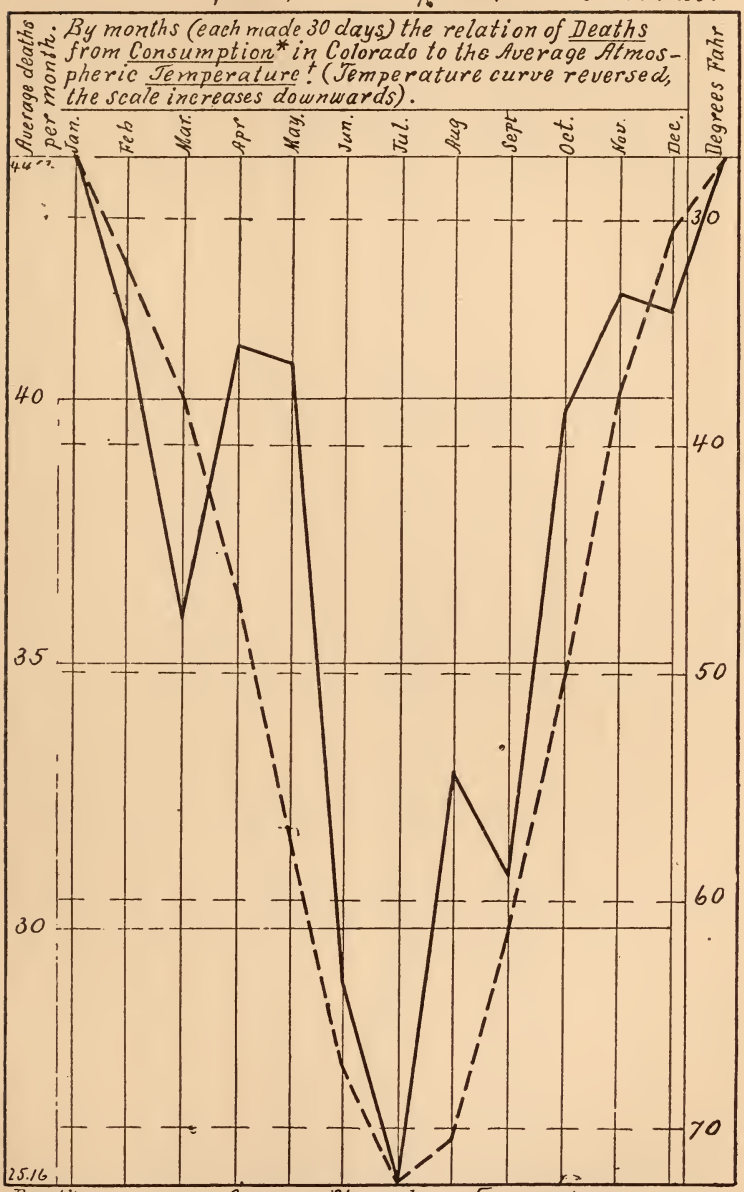
* From data in Vol. XII., Part II., page 61, Tenth Census Report, United States, 1880.
† From normals at six stations: Cincinnati, St. Louis, Memphis, Nashville, Fortress Monroe, and Philadelphia.
NOTE.—Table 4 is graphically represented in Diagram 4.

TABLE 5.—Exhibiting by months the average daily velocity of the wind* for a period of 16 years, 1872–87, at Denver, Colorado; also the monthly average rainfall* for the same period of time at the same place.

MONTHS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Daily average velocity of the wind, 16 years, 1872–87, at Denver, Colorado*.....	165·8	160·9	178·0	189·2	165·5	159·4	150·6	139·2	138·1	147·1	154·1	151·6
Average monthly rainfall, for 16 years, 1872–87, at Denver, Colorado*.....	0·639	0·487	0·926	2·198	2·784	1·508	1·728	1·606	0·926	0·731	0·734	0·721
Deaths from Consumption†.....	44·52	41·33	35·81	41·	40·65	29·	25·16	32·90	31·	39·68	42·	41·61

* The data for velocity of the wind and rainfall were supplied by Sergeant J. J. Gilligan, United States Signal Service, Denver, Colorado.
† From data in Vol. XII., Part II., page 61, Tenth Census Report, United States, 1880.
The lines, "average velocity of the wind" and "deaths from consumption" in Table 5 are graphically represented in Diagram 5.

No. 1.— Consumption, and Temperature in Colorado.



*The Temperature curve represents the Average for a period of 16 years, 1872-87. The data are from the Reports of the Chief Signal Officer, U.S. †The curve for Deaths from consumption represents the deaths occurring in Colorado during the census year 1870, in Denver during 1889, in Colorado Springs and in Boulder during a long series of years.

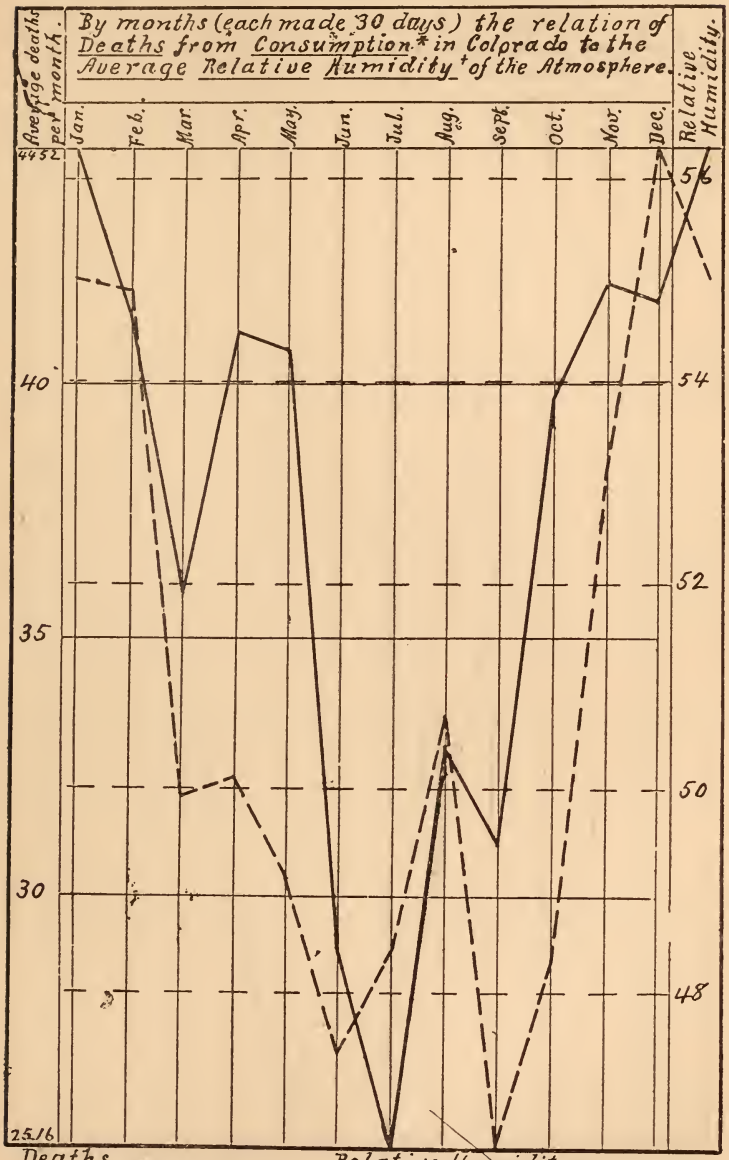
No. 2.—Consumption and Absolute Humidity in Colorado.

Deaths ———, Average Absolute Humidity — — —.

*The curve represents the deaths from consumption in Colorado during the census year 1880, in Denver during 1889, in Colorado Springs and in Boulder during a long series of years

† The absolute humidity was computed from monthly averages of temperature and relative humidity in Denver, Colorado, by Table X. Page B 93, "Smithsonian Meteorological and Physical Tables, 1859.

No. 3.—Consumption and Relative Humidity in Colorado.



*The curve represents the deaths from consumption in Colorado during the census year 1880, in Denver during 1889, in Colorado Springs and in Boulder daring a long series of years. †The curve for relative humidity represents the average for a period of 10 years, 1878-87. The data is from the Reports of the Chief Signal Officer, U. S.

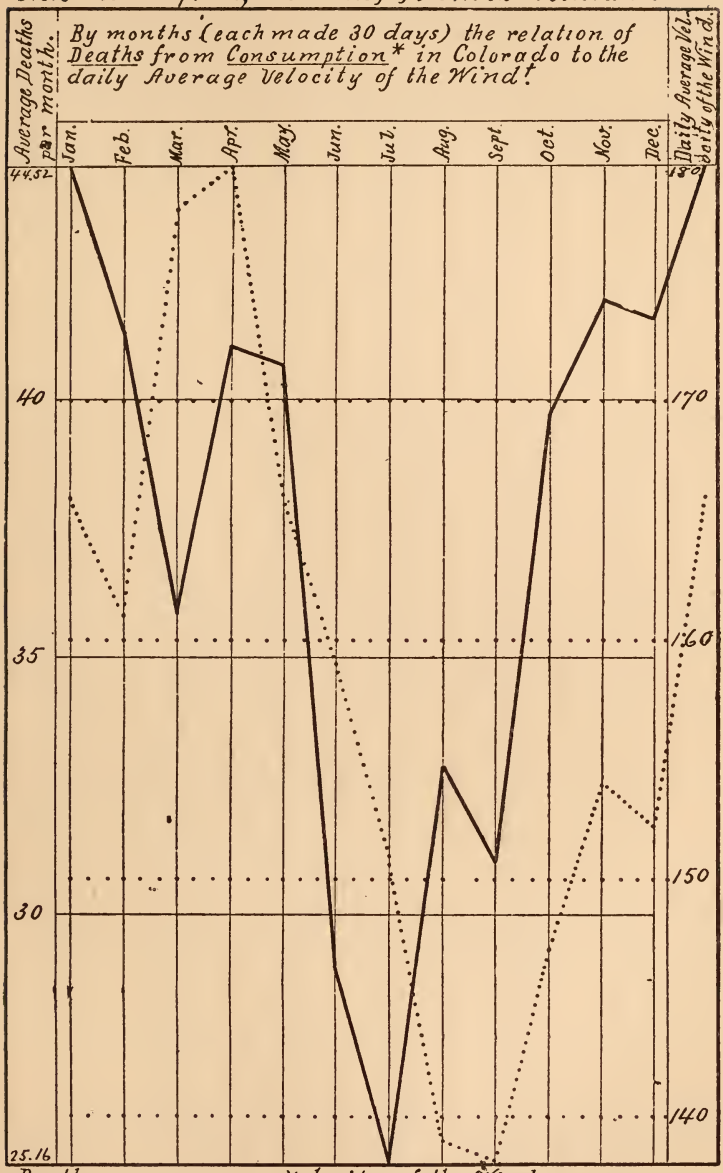
No. 4 – Consumption and Temperature in 31 Cities in the U. S.

Deaths ———. Average Atmospheric Temperature — —.

*The curve for deaths from consumption is made from data in Vol. XII., Part II. page lxi, Tenth Census Report, U.S. 1880.

† The temperature curve is made from the normals at six stations: Cincinnati, St. Louis, Memphis, Nashville, Fortress Monroe, and Philadelphia.

No. 5.— Consumption, and Velocity of the Wind in Colorado.

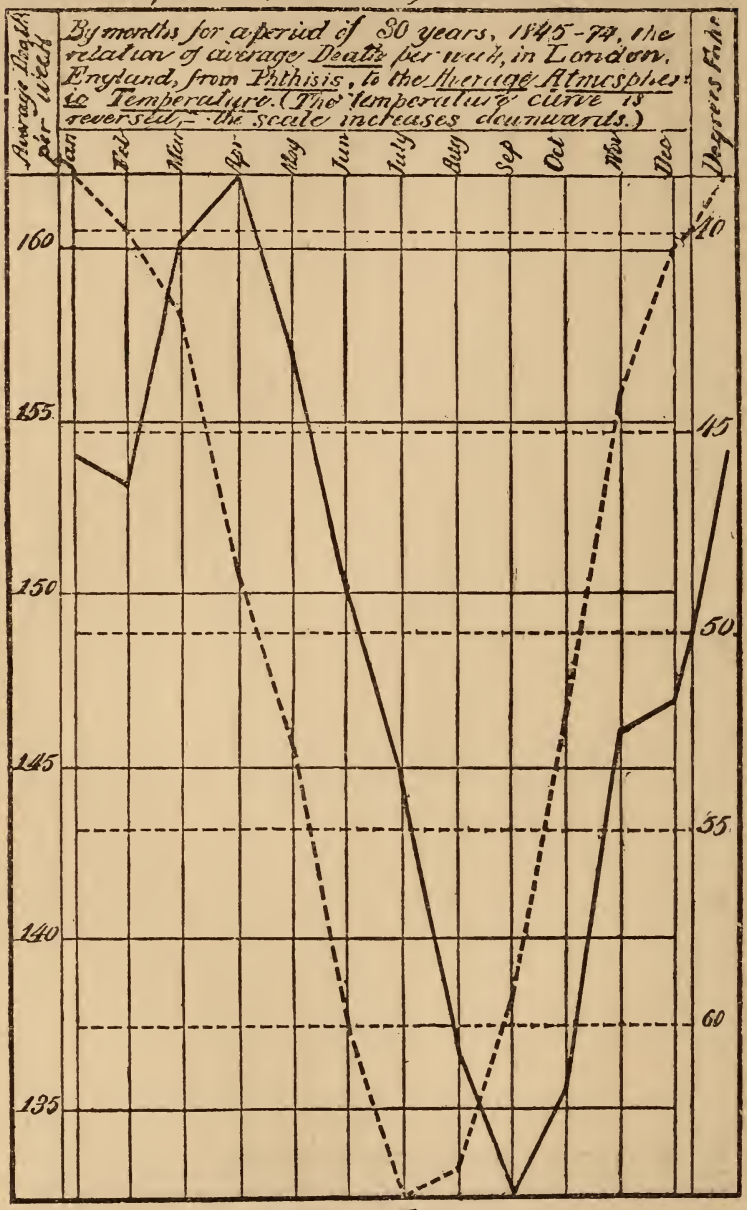


Deaths ———. Velocity of the Wind .....

*The curve for consumption represents the deaths occurring in Colorado during the census year 1870, in Denver during 1889, in Colorado Springs and in Boulder for a long series of years.

†The curve for velocity of the wind represents the daily average for 16 years, 1872-87, at Denver, Colorado. The data was supplied by Sergt J. J. Gilligan, U.S Signal Service Denver, Colorado.

No 6. — Temperature, and Deaths from Phthisis in London.



Deaths _____. Average Temperature - - - - - -

About 231.000 deaths from Phthisis are represented in this diagram data for which are from Jour. of Scottish Met. Soc., New Series Nos XIII, XIV, XV, XVI, pages 252 and 263.

No. 7 Temperature and Sickness from Consumption in Michigan.

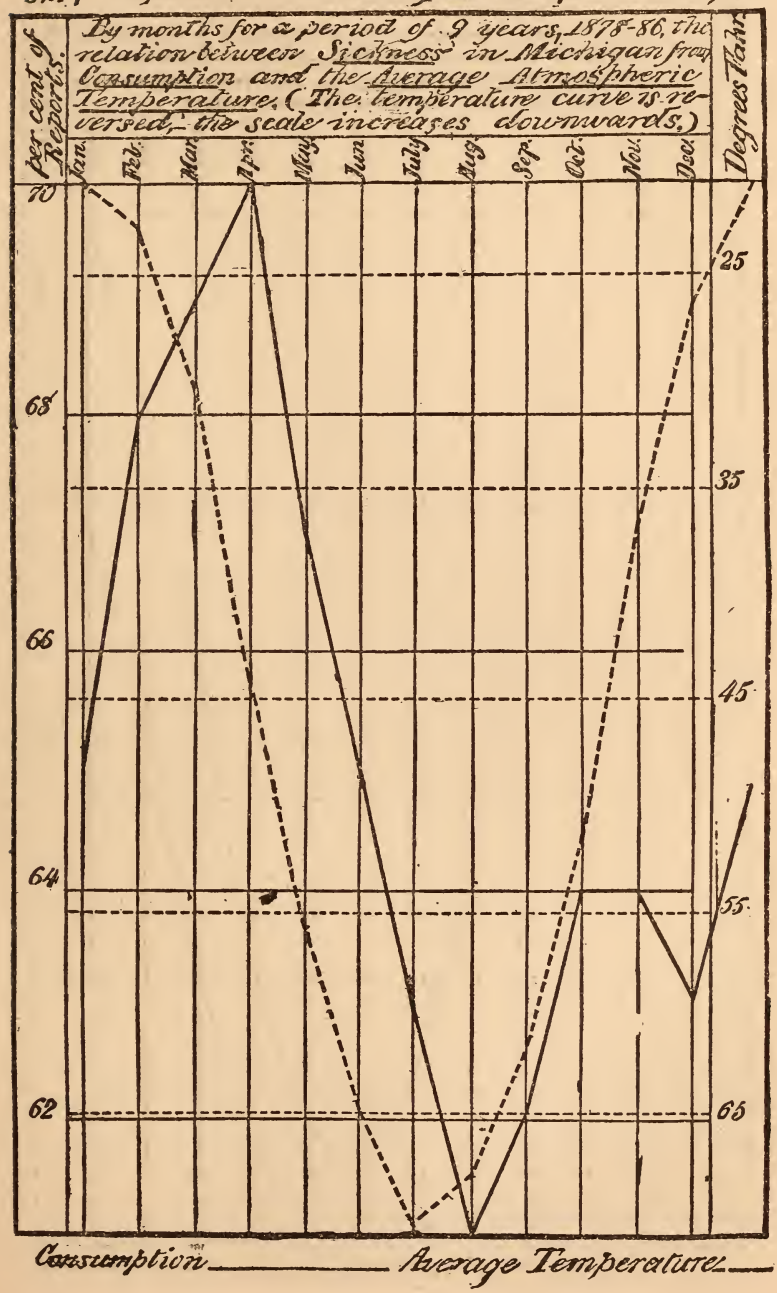
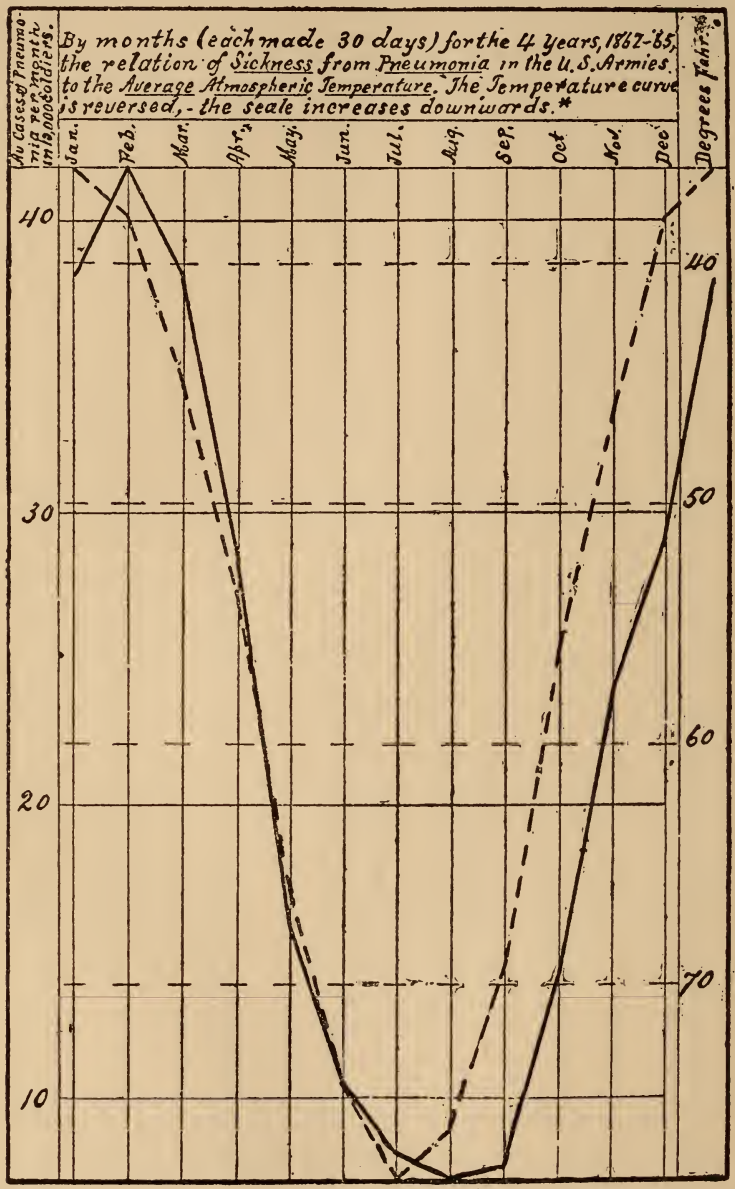


Diagram 8. Temperature, and Sickness from Pneumonia in U.S. Armies.



Pneumonia ———— . Average Temperature — — —

*The temperature curve is made from the normals at six stations representing approximately the localities occupied by the armies of the United States, during the war of the rebellion.

the mortality from consumption is much influenced, directly or indirectly, by the temperature of the atmosphere. There is such a general correspondence of the two curves (for consumption and atmospheric temperature) as to indicate some necessary relation between them. In fact the mortality follows the temperature curve with a less interval of time than is found to be the case in Michigan, in Massachusetts, in London, or in the United States Army. So far as relates to Michigan and London, this is shown by studying Diagram 1 in comparison with Diagrams 6 and 7. This seems to prove that in Colorado the deaths from consumption follow the fall in the temperature at least a month sooner than they do in any other part of the world which I have studied. We may well study further concerning this fact, in order to learn, if possible, the reason why this is so :

It will be seen by Diagram No. 1, relative to consumption in Colorado, that there are least deaths in the warmest month and most deaths in the coldest month, while in all the diagrams except those for Colorado, the curve for consumption, whether it represents sickness or deaths, follows *after* the curve representing the atmospheric temperature, there being usually one or two months between the temperature changes and the corresponding changes in the consumption. The same is usually true concerning small-pox, although in Diagram No. 4 there are exceptions to this. As regards small-pox (contracted because of the sore throat due to exposure to cold), it seems that to a person exposed to the inhalation of cold air it is usually a month or more before the small-pox proves fatal. The period of incubation being about half a month, the remaining half month or more represents the length of the fatal illness, and the time which elapsed between the exposure to the cold air and the contraction of the disease.* In have found that the changes in the *sickness* from consumption in Michigan and in the United States armies, follow about the same length of time later than the temperature changes, as do the changes in the deaths from small-pox

* In London, England, the changes in the deaths from small-pox follow at least two months later than the changes in the atmospheric temperature. There are nearly twice as many deaths from small-pox following the cold weather as there are following the warm weather.

—that is, one or two months later. I think the explanation probably is that consumption of the lungs is most frequently contracted in the same way that small-pox is—that is, by the specific cause being inhaled. Also that to persons having tubercular infection in some other part of the body, consumption of the lungs may occur through exudations brought about by exposure to the inhalation of cold air.

If these are the true explanations, then not only should the *sickness* from consumption follow the exposure, as it does, after about the same interval of time as does the small-pox sickness, but a portion of the *deaths* from consumption of the lungs should follow, as is the case, after about the same interval, because the exudations and the consumptive processes are increased by exposure to cold air. That all the inflammatory and exudative diseases of the throat and air-passages are increased by exposure to cold atmosphere, in Michigan and in every country in which the subject has been systematically studied, there can be no question. That the average deaths from consumption follow more quickly after the atmospheric changes in Colorado than they do in the other States and countries may, I think, be due to the assumed fact (I suppose it to be a fact) that the consumptive inhabitants of Colorado are, as a rule, nearer death than are the consumptive inhabitants in the other States and countries studied, that being the reason why they left the Northern and Eastern States to seek restoration to health in this favored region.

There is, however, another item of evidence in the same direction; the difference between the mortality during the warmest month and that during the coldest month is greater in Colorado than in Michigan, Massachusetts, or London, England. It is even greater than it was in the United States armies during the war of 1861–65, where the mortality in March was 62 per cent greater than it was during September, while in Colorado the mortality in January is about 77 per cent greater than it is during July. Taking the statistics as they are, it thus appears that not only do consumptives die *more quickly* on exposure to cold in Colorado than in other States and countries, but a much *larger proportion of them die* on exposure to cold, or if not that then Colorado is proportionately more favorable to consumptives in summer.

However, although I have been told by a few physicians and other residents who claimed to know, that consumptives come to Colorado at all seasons of the year in about equal proportions, yet from the best evidence I can obtain I am inclined to think that a few more come in winter than in summer, and that more leave Colorado in summer than in winter, and that a part of the greater number of deaths from consumption in Colorado during the winter is due to those movements of consumptives.

And the reverse of the foregoing is undoubtedly true of Michigan, of Massachusetts, and of London, England, as is distinctly indicated for the first and last-named places, I think, by the Diagrams Nos. 6 and 7, in which it may be seen that the curve representing the sickness (or the deaths) from consumption is so low from November to February as to be unaccountable by almost any supposition except that many consumptives left those parts of the world during the cold months. I think that, as a rule, they go to warmer climates, but I believe that some of them go to Colorado.

With the view of learning more, if possible, about these movements of consumptives, and the influence they have on the mortality and morbility statistics, I have studied the combined statistics of deaths from consumption in Northern and Southern cities, by means of a graphic diagram made from data in the United States Census of 1880. This diagram is No. 4 of the series made to illustrate this paper. From that diagram it may be seen, however, that there are still such depressions in the curve representing the winter months as to indicate that not so many consumptives are present in those cities, on the average, in the winter months as in the summer months. The reason for this is, perhaps, because the list includes more large cities in the Northern than in the Southern states.

CONSUMPTION, AND HUMIDITY OF THE ATMOSPHERE.

By reference to Diagram No. 2 it will be seen that the relation of consumption to absolute humidity in Colorado is quite close, as it has been found to be wherever the subject has been studied, the *most* mortality from consumption occurring in Colorado when there is the *least* vapor of water in the atmos-

phere, and the *least* mortality when there is *most* vapor of water in the atmosphere. The relation thus being inverse, the curve in Diagram No. 2 representing the absolute humidity, is reversed in order to facilitate the comparison. The comparison shows that there is a quantitative relation between absolute humidity of the atmosphere and mortality from consumption in Colorado.

Diagram No. 2 also exhibits the fact that there are a few very noticeable exceptions to the general rule of quantitative relation between absolute humidity and consumption in Colorado. And it is a fact worthy of especial study that the most of these exceptions seem to find explanation in Diagram No. 3, exhibiting the *relative* humidity and its relations to the mortality from consumption. Diagram No. 3 exhibits the fact that in Colorado there is—what I have not found to be true in any other State or country—a well-marked relation between the relative humidity and the mortality from consumption, there being noticeably *more* mortality in months when the atmosphere was *more* than usually saturated with vapor of water, and *less* mortality in months when the atmosphere was *less* than usually saturated. In Diagram No. 3, therefore, neither of the curves are reversed.

A comparison of Diagrams 1, 2, and 3 shows that in Colorado the relation of consumption to relative humidity is not so close and quantitative as is the relation of consumption to the atmospheric temperature and to absolute humidity, yet it shows that nearly all the departures from quantitative relations of temperature to consumption are in just those months when they are accounted for by the changes in the relative humidity—that is, if we accept the prevalent belief in the unfavorable influence of great relative humidity. The evidence in these several diagrams—1, 2, and 3—is in complete harmony with what I wrote on this subject some years ago when studying the subject for Michigan, and which I cannot now state in much clearer language: "Theoretically, it would appear that great relative humidity may be directly injurious to human tissues in cold weather by reason of the increased abstraction of heat from the body and particularly from the air-passages, because of the much greater specific heat of water than of air—the body parting with its heat by conduction so

much more readily to moist than to relatively dry air. The circulation of the blood through the lungs may be interfered with by such abnormal abstraction of heat while exposed to out-door air, and by the reaction consequent upon a return from such cold moist atmosphere to a heated room. Congestion of the lungs may perhaps be thus induced."*

For ages there has been a widespread belief that exposure to cold air that was moist, relatively, was injurious to persons liable to lung disease. Theoretically it was injurious, as I have just stated. We now have, in these tables and diagrams, evidence which is, to a certain extent, exact and quantitative, and is therefore available for study in a scientific manner.

It seems that, in Colorado, at least, relative humidity does modify the controlling influence which the fall and rise of atmospheric temperature has over the rise and fall of mortality from consumption ; a fall of about five per cent in the relative humidity, when the atmospheric temperature is about 60° F., causing a decrease in the mortality of about five-thirty-sixths—about one-seventh. Approximately this seems to be indicated by a study of the curves in Diagrams 1 and 3 for the month of September, estimating what the mortality might have been in September, if midway between what it was for August and October. Again, the diagrams show that in March a fall of relative humidity (of about three per cent) is associated with a fall in the death-rate from consumption equal to about five-fortieths—one-eighth of the whole.

Of course I am speaking only from the evidence which I have been able to collect. I regret that the statistics of mortality in Colorado are so meagre. And it is especially to be regretted that we have not for Colorado, as we have for Michigan, statistics of the *sickness* from all the important diseases. What information is of more value than that which relates to life and death—that which should enable us to know just what conditions tend toward continued normal life, and what conditions tend toward deaths "as the fool dieth"? For truly, now, as in the days of Hosea (4 : 6), our "people are destroyed for lack of knowledge."

* "Causation of Pneumonia," Report Michigan Board of Health, 1886, p. 284.

CLINICAL EXPERIENCE.

In this connection, however, I wish to try to correct one prevalent error. We have some knowledge which is positive and useful, and when discredit is attached to it progress is retarded. It is a common thing to discredit statistics. People seem to forget that statistics consist of numerous facts, and that the greater the number of facts of a kind that are brought together, the greater is the probability of the truth of the average statements of them, because errors of statement tend to balance and negative each other, and the general fact thus becomes constantly modified toward the exact truth. When one is tempted to declare that conclusions based upon these statistics of consumption are "groundless," because they do not coincide with what he believes is the "general clinical experience,"* he should reflect that these statistics *are* the "general clinical experience." The facts I have used relative to consumption in Colorado include those from the clinical experience of such good men as Dr. Ambrook of Boulder, of Dr. Horn, of Colorado Springs—and they would have included the results of the clinical experience of other prominent physicians in Colorado if they had responded to my request by giving such facts. To be sure we have for Colorado only the facts respecting the *deaths* from consumption, but for the State of Michigan we have the records of the *sickness* according to the "clinical experience" of the leading physicians of the State, because we have, for many years, their weekly reports of sickness under their immediate observation. That is the basis for the curve in Diagram No. 7, representing sickness from consumption and its relation to the atmospheric temperature. The "clinical experience" of nearly all of our army surgeons during the last great war is represented by the curve for deaths from consumption in a diagram published in the *Journal of the American Medical Association*, January 18th, 1890, and which is almost identical to the curve in Diagram No. 4, which I now present, and which represents the deaths from consumption in thirty-one cities in the United States. In Diagram No. 8 is a curve correctly representing sickness from pneumonia according to the combined "clinical

* Journal of the American Medical Association, 1890.

experience" of all of our army surgeons during the last great war. It proves conclusively that sickness from pneumonia was quantitatively related to atmospheric temperature.

One point I wish to make in this connection is that "clinical experience" is generally valuable in proportion as conclusions from it can be based, not on one experience, which may be exceptional, nor on a few experiences, which still may not teach the exact truth, but upon large numbers of experiences properly classified, arranged, and consolidated into what we call statistics.

On this same principle the vital statistics of Colorado should be studied in connection with the statistics in other States and countries. The statistics of consumption should be studied in connection with the statistics of other diseases. It seems to me that a careful study of the subject of this paper, in this manner, taking into account work done heretofore, leads to the general conclusion expressed at its beginning, "that certain meteorological conditions are related closely and causally to all the important ordinary diseases of the lungs and air-passages," and to all communicable diseases like consumption, small-pox, etc., which usually enter the body by way of the air-passages; the evidence is still "of such a character as to lead me to think that similar causal relations prevail throughout the world."

In Colorado, as in other parts of the world, deaths from consumption result from being in an atmosphere that is cold and dry, absolutely. In Colorado, at least, the *saturation* of the air with vapor of water apparently increases, and the reverse of this process decreases the unfavorable effects of a cold atmosphere, toward the causation of deaths from consumption. In Colorado, as elsewhere, the danger from consumption is much greater in winter than in summer; that is to say, it is greater in cold weather than in warm weather. My own belief is that this will probably be found to be a universal law. If so, it has an important bearing upon human life and health.

It is of such great importance that this law, if it is a law, shall be established on a firm scientific basis that, in this paper, I refrain from complicating the study of it with any question whether the relations of these meteorological condi-

tions to diseases of the lungs and air-passages are direct or indirect.

I do not claim that this is a newly-discovered law. I have known it for several years. Apparently it was well known to Hippocrates,* so far as relates to temperature and relative humidity, although, in his day, he could not have had any accurate thought of absolute atmospheric humidity, and he must have assumed, as many who are ignorant of the subject now do, that the relative or *apparent* humidity coincides with the absolute humidity which, generally, is the reverse of the truth, as is shown by the tables and diagrams which I present herewith. But no natural law is of use to mankind until it is established, accepted, and acted upon. My sincere hope is that members of this Association will devote sufficient attention to this subject to settle the question definitely and for all time ; because it is not only a primary question, it is a fundamental question in biological climatology, and without the settlement of such questions there can be no science of climatotherapy nor of sanitary climatology.

* Set forth in his book on "Airs, Waters, and Places," namely, that cold and damp weather produces diseases of the respiratory organs. John S. Billings, M.D., "Introduction to Buck's Hygiene," Vol. I. p. 34.

DISCUSSION.

Dr. Ingalls: Mr. President, I have been exceedingly interested in this; and I have very little to say, except that I want to call the attention of the Association to something that the doctor merely glanced at in going over. As we came on from Chicago the doctor was speaking to me of his charts, and this wind-line was not in any of his charts, and he did not know anything about it then. He pointed out the relation of the death-rate and the temperature to me; but he says, "There is a point, and there is a point, and there is a point; I don't know what is the matter. I don't know what causes that; and I am going to see if I can find out anything more."

It seems to me exceedingly interesting that the wind-line seems to account for this irregularity in his death-rate, that he was not able to account for in any other way. It precedes the death-rate by about a month in all cases, this preceding that about a month, this preceding that about a month, and this one precedes that.

Dr. Denison: (Referring to sketch on the blackboard. Diagram No. 5, page 315.) Does the down-stroke of the dotted line correspond wih the up-stroke of the other in time?

Dr. Baker: No. The reverse of that, as a rule, as stated by Dr. Ingalls, who stated it correctly. Under November, this point here, in the dotted line representing the wind (Diagram No. 5, page 315), coincides with the solid line representing consumption—both lines rising to November and falling to December. This rise in the wind in March, however, precedes the rise in consumption just one month. The rise of the wind in March and April seems to have causal relation to the rise of consumption in April and May, and no other meteorological condition studied has such relation to the extent of controlling the disease. In September and in December the fall of the curve representing the wind is coincident with the fall of the one representing the mortality from consumption, and the fall or decrease in the wind is such, quantitatively, as would be expected to have influenced the decrease in the consumption. And, although the fall in the

relative humidity may have had influence in September, no meteorological condition studied, other than the wind, accounts for the decrease in consumption in December.

I think this Diagram (No. 5, page 315) when taken in connection with the others (Diagrams 1, 2, and 3) relating to Colorado, supplies, for the first time, conclusive evidence that the wind has causal relations to deaths from consumption.

Dr. Denison: I would like to say a few words about the paper, and partly to explain why I could not help the doctor, as he wrote to me about the statistics, more than I did. My practice is of such a kind that I have not pretended to keep any tabulated statistics of deaths, and I could not furnish the evidence that was wanted in any way that would be accurate. My only recourse was to see the Health Commissioner, and ask him to afford Dr. Baker every facility that his office could give him. The subject is certainly very interesting. I do not wish to decry or lessen the value of statistics, especially when they can be taken and studied on a broad basis. Nevertheless, it is so that we can prove almost anything by statistics. That is, there is a possibility to prove even a theory which is wrong, by statistics.

I gave a great deal of attention to gathering up the combined opinion of physicians at one time, and went to work and sent out as many as three thousand letters with certain questions to be answered, and I received seven hundred replies, some of which must have taken those physicians half a day to compile and answer, with reference to their practice; and yet Dr. Lusk, when he answered those questions, decried the idea, because he said the average was not the thing we wanted—that didn't give the truth; that he would give more for any one individual's opinion, after he had studied those statistics, than he would for the sum total or average of the medical profession.

Now that same idea refers somewhat to statistics. For instance, if we reason in one line, and it were possible to give as fair a reason in another, the reasoning on the first line, whatever it may be, is in so far vitiated by the second reasoning, which is opposed to it. Now, if I was to reason with regard to the effect of *cold* particularly, and that is one of the points raised, the question of the habits of life must necessa-

rily come in, as the doctor has mentioned, which may have quite as much to do, perhaps, as the effect of cold itself. The changes of temperature between the rooms we live in and the out-door air, that great contrast in temperature that comes with people coming to live in-doors as the cold weather of fall comes on, I claim is of greater influence than the cold itself; the contrast between the hot houses we live in and the cold we go out into, the shock to the system which is every day met with, and which is particularly injurious to the very old and the very young. We see these effects in Colorado, particularly with reference to broncho-pneumonia and bronchitis in children in the winter season, and the deaths which occur among old people in cold weather.

The doctor's reason is in harmony with this result; but can it not come quite as much, I ask, from the contrast in the temperature between in-door life and out-door life as any other way? Where the conditions, as in Colorado, are so favorable to living out-doors in summer, this solution of the question is favored by the records of the mortality statistics. Then again, the deaths from debilitating diseases must, of course, come at a certain period subsequent to the real causes of the same. Is it not quite possible that those deaths which occur in the autumn, the climax being in December, according to the record, were caused by the heat of summer? It is certainly true, and the record bears it out, that the average improvement of consumptives is as good in the winter as it is in the summer for those who are able to live an out-door life. Where they are housed, this very argument I have mentioned has a deleterious effect—that is, if they cannot go out at all, or very seldom, they are not living an out-door life, and the injurious effects become manifest, due to changes from hot rooms to cold, out-door air—and we know what heated apartments some of these consumptives will keep themselves in, hugging a stove and not going out-doors at all. I don't believe the human race was intended by God Almighty to occupy the kind of houses we live in, or to live in the way we do. There is something wrong, we are out of joint somewhere, that so large a proportion of the human race should be constantly dying of consumption, when no illustration of such a mortality can be found in any other branch of the animal kingdom.

Now, as to how the statistics might be influenced by the time consumptives come here. The very feeble cases are always housed over winter in the East, and come here in warm weather. There is a forlorn hope that they can pass another winter—and the hope is very forlorn sometimes—when they are in acute conditions, and with excavation, it may be, in both lungs. It must be that the exciting effect of the high altitude and the serious condition of their disease will culminate in the fall and cause an increased mortality.

I will not mention the influence of the diagram the doctor gave (No. 3) with reference to relative humidity, simply because it is so favorable to Colorado ; but it seems to me it is somewhat in harmony with the wind diagram, showing that increased velocity of the wind, and the changes of temperature which that increase indicates, perhaps may have a causative influence with reference to the deaths from debilitating diseases, particularly consumption, afterward.

I feel as though these points (the sickness of very young children and old people in an exciting climate, with the lessened temperature, particularly the extremes of winter) have a modifying influence, and may possibly explain some of those points. I don't remember how many cases are included in the paper to make up the average in total, with reference, for instance, to the relative humidity chart.

Dr. Baker : It is stated in the table. The same number is used as to each one.

Dr. Denison : I want to make the proposition that perhaps the fall of temperature may indicte a disintegrating influence. The improvement which occurs in some, and the inability to stand the increase of cold in others, may be a disintegrating influence between those cases which will improve and those which will retrograde. The trial will have to be made, and if they stand the change and live an out-door life in cold weather, the improvement will be very great.

The case which Dr. Knight has seen to-day is a very good illustration of that, she having excavation in both sides. That woman came here quite a number of years ago, and she has weathered the winters and improved in winter ; but this summer she has had a continuous fever and an increase in breaking-down. I think there was something of this ill effect last

summer, and for that reason I kept her out in the foot-hills, where the weather was cooler in the summer. It is possible that cold is a sort of levelling influence, showing what number of cases may improve and what number may retrograde as the cold of autumn or winter comes on.

Then, again, the facility for out-door exercise in the warm weather is another modifying influence, the feeble consumptive perhaps housing himself as the cold or fall comes on, and shutting the windows, and no longer sleeping with the windows open. There are a great many things that may influence this curve and explain the coincidence which Dr. Baker says would occur.

Dr. Solly: I didn't hear the whole of the paper; but, as I understand it, the general conclusion is that the cold, dry air causes death from consumption—the number of deaths from consumption is increased when the weather is coldest and dryest.

Dr. Denison: The record of one of the charts shows that the deaths decrease with the dryness and increase with the relative humidity; but the coldness was the other point.

Dr. Solly: To speak with reference to the coldness, I think Dr. Denison's suggestion is a very good one—that people don't die from the cold outside, but die from the heat inside, and then going into the cold outside. It is the condition in which they keep their houses, and I think that is very probable; and then, as he suggests, it is the time of year in which they would drop off after the heat of summer. I think, in taking cases of consumption, as to the effect upon the disease—not death from consumption, but the effect on the disease—it is reasonable to suppose it is good for a patient who is tending to improve from consumption, and has the capacity to improve, and those who are on the decline, whose death is almost a moral certainty; it is precipitated by the change between out-door air and the in-door air, and such extremes of temperature will brace up and do good to the invalid who has the ability to stand it and a tendency to improve, and will cause those to drop off who are on the decline. We know in old age how much better it is to keep a person on what they call an even keel, applied to the question of levelling things down to a certain grade, and keeping it down to that point.

I remember how much better they did in London, where the dangers are pretty well modified, and the conditions are pretty much the same, than in the country. Younger children do better in the country than in the city ; so in the disease ; in the declining stage of the disease, we can see how, when there are these shocks encountered from coming from the heated air of the house into the cold air outside, why it should precipitate the termination of the disease ; and that probably is the explanation of it.

I see by one of those charts that the greatest mortality is in January, and then it rises again, I think, in May ; it falls between the two periods.

Dr. Baker : This is April and May.

Dr. Solly : In speaking of this it is certainly a matter of suggestion and impression. The doctor has certain facts with which I am not sufficiently familiar to criticise. As to the question of the weather, there is sufficient data for him to go upon to justify those charts. I don't know from my experience, but my clinical experience, as it impresses me is, that those cases of consumption, even quite advanced ones, if they will remain out-of-doors most of the days and keep their houses down in temperature, will go along through the winter, and generally succumb in the spring. I should certainly think in my own practice most of the deaths from consumption have occurred in the spring, as it is more common in chronic diseases all over, that they go through the winter and decline in the spring usually. I have seen bad cases recover, if they stay out-of-doors all day during the winter ; but those who house themselves, it is very common for them to drop off suddenly—they can't stand the shock of the change.

Dr. Bowditch : An open silence on my part would not indicate a lack of interest in Dr. Baker's paper ; it would simply indicate a feeling of inability to discuss it.

Clinically speaking, in Boston, I would say, from the middle of December to the middle of February, when we are liable to have our coldest and dryest weather, I never feel the anxiety for the consumptive patients that happen to be under my control, as I have in the latter part of the autumn or early spring, when we begin to have our hard rains and humid winds, which I think would agree with Dr. Solly's remarks.

Dr. Baker: Mr. President, having stated in my paper that I considered of so great importance the question of whether what I have presented is a universal law or not, that I did not enter upon the question whether the influence of temperature was direct or indirect; yet I wish to say a word in response to the remarks of the President.

I think all of us would agree with him theoretically if we had no positive evidence; but when we come to take the statistics that have been put before us here to-day, and when we consider those that have been published heretofore, the theoretical considerations do not seem to harmonize with the facts I hold in my hand and you have in the printed series, the Diagram referred to, relative to "Temperature and Sickness from Respiratory Diseases in India," and the temperature there ranges from 70° to 85° F. Now try to imagine a shock to the system from being in-doors and going out-doors there. It seems to me we cannot imagine it. And yet in India the curves representing the meteorological conditions are like those representing the sickness conditions, just as though the two curves had been put on the diagram with a pair of calipers—one follows the other immediately nearly all the way around. Take, again, the statistics in the United States Army; there is a diagram here in this printed series numbered 8, showing that in the United States armies during the great war, the changes in the sickness from pneumonia followed immediately after the changes in the atmospheric temperature, among those soldiers, many of whom were out-doors in tents and in huts.

The facts as they occur in the statistics that have been set forth before, relative to persons living in-doors, and those living out-doors, all harmonize; and here, too, you see the same thing is true in Colorado; the changes in the sickness occur just in accordance with the evidence elsewhere—the exposure to wind, cold and dry air, is followed by sickness from the respiratory diseases and from consumption. That has a bearing, in my mind, as an answer to the question implied by Dr. Solly's remarks, and the President's, as to whether there were facts enough upon which to base a conclusion. The statistician, I think, judges of that also by the way the curves go; where we have, as we have in most of these diagrams in

the printed series, the facts of one month—just exactly what you would expect them to be—from those relative to the preceding and following months, it tends greatly to strengthen the belief that we have the facts as they belong. Of course where there are fluctuations, as there are in that death curve —(deaths from consumption in Colorado)—then doubt is thrown upon it somewhat; but when those fluctuations are just in accordance with what we believe to be a general law (that is, if we believe the effect of low temperature is emphasized and made more impressive on the system by relatively saturated air), and the curve of relative humidity fits in with the other evidence, as it does relative to Colorado, then it tends to strengthen the belief that we have sufficient facts. Now the diagrams that I had constructed before I left home, with reference to the conditions here in Colorado, especially after having reviewed the conditions since I came here in connection with the evidence of the statistics of the wind, convince me that I have sufficient facts relative to Colorado to base conclusions upon.

Of course I should like to see more, but to me it is conclusive.

As to the exact number of deaths, I don't find it stated in the table, but before the paper is printed I will supply it. I see there are about 40 deaths per month; that would make 480 deaths—probably about 500 deaths only; but to me the evidence is quite conclusive that we have the facts before us.

SOME NOTES ON NEW MEXICO AND THE ADJACENT PLAINS.

By Francis H. Atkins, S.B., M.D., of Las Vegas, New Mexico.

In offering this homely study of the climate of the dry Western plains, and especially the northern and eastern portion of New Mexico, I propose to bear so hard upon my own observations in the last seventeen years as to endanger eliciting comparison with Lord Erskine, whose parliamentary addresses were hopelessly beyond the printer's reproductive powers, as the stock of type representing the letter I invariably ran out during the composition of the first page or two.

My notes take their course by reason of a suggestion coming to me at a meeting of the Lodge of Odd Fellows at my home, Las Vegas, New Mexico, where a brother given to travel beyond the wont of most of us, while considering its finances, congratulated the Lodge one night on the infrequent drafts upon its treasury for sick benefits, adding that in his visits to Eastern lodges he was impressed by the many names of sick brothers called off each evening, while in our happy body weeks and months passed without a brother reported sick. My ready inferences as to the healthfulness of the town and speculations thereupon have led me to offer some odds and ends of evidence as to the salubrity of the region specified, to mention the diseases that have been rare or absent, to describe candidly some of our disadvantages, and to commend the climate in certain details.

As two of my friends from New Mexico are posted for papers on the relations of its climate to phthisis, to be read at this meeting, I will omit direct reference to that topic, especially as I wish to show that Coolidge's inferences from army records away back before the war, the first scientific deductions as to the advantages for consumptives in this region, and the much elaboration of the same since, do not mark the limitations of the arid parts as to the absence of disease or in its prevention.

Coming on the plains as medical officer to a military post seventeen years ago, so placed that the nearest physician to me in any direction was 115 miles, the next 130, and the third 225 in (Denver), it chanced my finger touched whatever public pulse there was in those days and parts. Six and a half years' practice on the plains, presently more thickly settled, at elevations of 2000 to 3500 feet, and ten and one-half years at altitudes above 6000 feet in denser settlements of New Mexico, afford the basis of these remarks.

In spite of small figures, usually thought to vitiate statistics, much can be learned from the study of sparsely settled regions or small municipalities; so, hoping my matter will not prove wholly trite, I make bold to offer so scientific a body these humble details.

Let me first mention a few diseases, absence or rarity of which renders fortunate these arid plains and plateaus. The absence of idiopathic acute pleurisy with effusion has been most striking, but one case originating here having fallen under my notice—that of a young man, cook in a large hotel—nor has it seemed to occur as a complication in other diseases. Twenty-one physicians averaging, perhaps, eight years each in New Mexico, whose experience I solicited, report fewer than two dozen cases as the result of their joint observations. The same considerable experience reports eight cases of empyema—of which I saw none—including four instances of thoracentesis.

Inflammation of the meninges of brain and spinal cord, except of tubercular etiology, must be vastly rare. I have seen none.

Hay asthma, common enough elsewhere to provoke hegiras and promote golden harvests at certain immune resorts, has been exceedingly rare. I have treated no case, nor heard of but one or two, though occasionally a marvellous cure by this climate is observed. My correspondents report fewer than a dozen cases, themselves twice the victims.

Judging solely by my own contact, I should rate acute articular rheumatism as formerly seen by me in the Mississippi Valley and the Atlantic States, and as depicted in books, an extremely rare disease. My observation of it has been limited to one well-marked case in Western Kansas twelve years ago,

shown me by a friend, and that had originated farther East; and one very slight case—a single joint moderately swollen, in a young woman of Las Vegas, was actually my only case originating in the dry country; but I have treated three youths of 10 to 20 years for valvular cardiac lesions where mild attacks of articular rheumatism had preceded. My correspondents, however, risk the trustworthiness of my notes by reporting such figures as 15, 20, 25, and even 50 cases (the last among miners at great altitudes). I would respectfully state, however, that to a certain extent I doubt the diagnosis of some of my friends. The disease is surely uncommon in Las Vegas, its joint-wrenching tortures being almost never heard of; and some of the cases I have investigated proved to be genuine gout. Moreover, as a correspondent of age and long experience writes me, he has seen "not a single case, but no end of muscular and other forms;" and right here, between the articular manifestations of gout and the pains of gonorrhœal and syphilitic rheumatism and the myalgia, so common in New Mexico from the prevalent lithæmia, lies the error in diagnosis, I suspect, which emboldens me still to assert that here, as compared with moist Central and Eastern climates, typical acute articular rheumatism is a rather rare disease.

Diabetes mellitus I have happily never met nor heard of about me, save in one case, now in a friend's care at Las Vegas, in the person of one reckless in drink. Of diabetes insipidus I have seen three strongly marked cases, perhaps idiosyncratic in its causes rather than climatic unless as an erethitic outburst.

Non-tubercular diarrhœa among adults has been infrequent; dysentery exceedingly rare, and the abdominal disorders of childhood markedly uncommon and mild; in my walk, but one death in seventeen years in an ill-cared-for infant, whom I saw but once.

That typhoid-fever assumes a milder form on the mountain flanks, my medical friends in Las Vegas and elsewhere join me in believing most cases varying decidedly from the classical type in having a cleaner, moister tongue, and more rarely much diarrhœa, tympanites, or delirium, and in being less fatal.

Most significant has been the entire absence of chronic

Bright's disease. To point its infrequency, notice its prevalence elsewhere.

Delafield says, in Pepper's System, concerning chronic diffuse nephritis: "In New York it is of very common occurrence," and the death record of that city marks the loss of life from this affection as resting chiefly on males between 30 and 60 years, and on females between 20 and 55, thus depleting the population in the years of prime usefulness. Recent statistics show an apparent steady increase of it in Massachusetts, rising from 10.5 per 1000 deaths in 1870, through 19.7 in 1880 to 30.5 per 1000 deaths in 1886.

In the Boston City Hospital in one year 1 in 36 of all medical cases was Bright's disease, and it caused 9 per cent of all deaths on the medical side; 10 per cent in another year.

Even of the selected class of men whose deaths to the number of 2000 in the whole United States are reported by a good life insurance company, so large a percentage as 5 to 6 died by this affection.

In one instance last winter, in the person of a Mexican about 30 years old, I had reason to suspect chronic renal degeneration. After a year of steady failure of vital forces without specific symptoms, a single thorough investigation failed to suggest a cause until examination of the urine revealed a little albumen, with a few hyaline and granular casts; specific gravity 1020. In three weeks he died without any of the characteristic explosions of Bright's disease; but, being 30 miles distant, an autopsy was impossible. This was the only instance under my notice, even suggesting this disease originating in the dry region.

We often discover such degenerations among our visiting consumptives, however, though I have suspected no death from the complication. My correspondents, again, report several cases among Americans and natives—possibly 20 cases in all in 168 years of practice, so to speak—though I should fear too much dependence on the mere presence of albuminuria and too little use of the microscope in the diagnosis of some of these cases. They also speak of acute nephritis after malarial fever, diphtheria, measles, and after scarlet fever, where alone I have seen it. The nephritic complication of advanced pregnancy has appeared occasionally.

The Rocky Mountain region has been reputed as fostering the various diseases of the nervous system. A few rather grave cases of hysteria, rising to acute mania or degenerating to catalepsy and endangering life, have certainly suggested climatic aggravation. Chorea occurs occasionally, yet is not common. Epilepsy must be rare. Nervous functional disturbances in women and in advanced consumptives are of daily observation, and we learn to warn Eastern friends not to send here persons subject to such exacerbations.

I am satisfied that labors are shorter in New Mexico than in the northern Mississippi Valley, for instance, and that the lochial flow is of briefer duration.

The census of 1880 gave New Mexico unenviable supremacy in the United States as to the number of blind persons per thousand inhabitants. This seems to relate exclusively to the Mexicans, whose children meet innumerable accidents or suffer unrelieved from violent inflammations, for diseases of the eye, from cataract to conjunctivitis, do not seem to be over-frequent among Americans.

Here, also, I am able to corroborate Dr. Solly's exception this morning in favor of many cases of heart disease; when neither greatly advanced and when free from pulmonary and renal complication, these have seemed to sustain no detriment even though vigorous vocations and avocations were pursued. Let me now offer a few figures otherwise suggesting the healthfulness of this region.

Using the large statistics of the Odd Fellows' Order for a recent year, it appears that whereas there died in Louisiana 18 Odd Fellows out of each 1000, in Missouri and New Jersey each 13, in Massachusetts 11, in Ohio 10, in New Mexico the figures fell to 9 per 1000.

While in these other States from 9 to 12 per cent of all Odd Fellows received sick benefits, in New Mexico but 7.7 per cent were so relieved, or, stated otherwise, the mortality in these other States exceeded ours from 11 to 100 per cent, while the number of members shelved by disability was from 25 to 56 per cent higher than ours.

The time lost from his vocation by each sick Odd Fellow gives more striking results. While every such beneficiary in Massachusetts lost 7 weeks, in New Jersey 8, in Ohio 9, in

New Mexico he lost but $4\frac{1}{3}$ weeks (in 1889 it fell to 3 weeks for New Mexico) or, averaging the loss of valuable time for each member of the order, sick or well, it required only $1\frac{1}{8}$ Odd Fellows to use up a week in sickness in Ohio or New Jersey, in Massachusetts $1\frac{1}{5}$, while in this wholesome territory 3 Odd Fellows might be told off before a week was lost from disability. That is, in Ohio and New Jersey about threefold the time was lost by physical incapacity among these adult Male wage-earning citizens as in New Mexico.

Wishing especially to mark the climatic merits of Las Vegas, I will add that with an average in 3 years of 88 members in its lodge, the percentage of relief was only 5 as against 7.7 in all New Mexico, or near 12 in Massachusetts, and it took $4\frac{1}{2}$ men to consume one week per annum in sickness as contrasted with 3 men per week for all New Mexico, or $1\frac{1}{8}$ for Ohio or New Jersey.*

A certain lodge in Ohio, accidentally chosen by me, relieved 22.5 per cent of its members against 5 per cent with us, or one week was lost for every $\frac{1}{2}$ an Odd Fellow in that lodge to 1 in $4\frac{1}{2}$ members in Las Vegas, or, finally, the Ohio lodge was nine times as sickly as my lodge.

Here let me remark that my humble figures are enhanced in value by the recollection that the average vitality of our community is decidedly diminished by the number of individuals or families already weakened by disease or sinister inheritance who have poured into our territory, and that an unusually large proportion of New Mexican Odd Fellows being railroad men or coal-miners, much of the disability has been from accidents. The only deaths that have occurred in my lodge in the past six years were one suicide, not in good standing, and so not entitled to receive funeral benefits or even be accounted for by the lodge, one visiting consumptive, inadvertently let into the lodge contrary to rules, and one old man with heart disease of long standing, who had sought better health in New Mexico, and, at last, after years of renewed usefulness, succumbed to pneumonia.

* The figures for the Las Vegas lodge would appear much more advantageous were I to omit one case where sick benefits were long drawn by a brother whose incapacity was dishonorably incurred, and he therefore not entitled to benefits.

I understand that a large part of the business of any Eastern domestic practitioner consists in attention to sick children. I also notice that in one year in New York City 47 per cent of all the deaths were in children under five years of age. Of course I do not presume to contrast a Rocky Mountain village with the great metropolis, but refer to these terrible figures to recall more vividly that disease and death are disproportionately active in "the States" among children at that tender age. So in Manchester, New Hampshire, during the July just past, in a total and extraordinary death loss of 124 persons, no fewer than 83 were two years old or under.

My own practice being essentially domestic, I questioned my books as to the children under five years of age waited on by me in a year.

Taking my cash book for easy reference, for the fifth year of a well-established practice in a town containing 2800 to 3000 Americans and as many Mexicans, with a considerable vicinage practice attended in town, I found that but $5\frac{1}{2}$ per cent of my receipts that twelvemonth was derived from the care of infants of the age specified. Of the money so received, $\frac{1}{5}$ came from the single case of a child brought in sick from a neighboring commonwealth, and $\frac{1}{10}$ arose from vaccinations, and no dollar of this represented a fatal case. These happy circumstances I attribute exclusively to the beneficence of our climate, and by no means to any excess of skill on my part in prevention or in cure.

No feature is more striking to a Las Vegas physician than the very large proportion of comparatively insignificant cases he sees, the infrequency of grave ones marked by the long spells in which, though earning something each day, his fever thermometer lies idle, or he need rarely use his skill in urinology.

Turning the leaves of my case book in search of evidence of gravity, I find in the first half of the same year (and that is always our busier half), one mild case of croupous pneumonia, three cases of catarrhal pneumonia (two in adults, one being fatal in a wrecked drunkard)—and this is not one of the scourges of juvenile life here as at the East,—two mild cases of facial erysipelas, one fatal case of puerperal fever, three cases of diphtheria, two being fatal, and three mild cases of typhoid-fever.

But the cases mounting highest in number were of indigestion and biliousness, eczema, pharyngitis, and tonsillitis—all of a rather mild type, though I suspect climatic relations for the digestive disorders, as discussed later, and for the skin and throat affections in the irritation of high dry winds carrying dust. Beyond these there was a large assortment of ailments strictly non-climatic, as poisoning, traumatic lesions, tapeworm, bunion, burns, besides vaccinations.

So, also, the number of deaths remained low in the first half of the present year, though an unprecedented invasion of zymotic diseases swept our community, largely increasing our work ; even the all-searching influenza causing but one non-Mexican death, in the person of an aged Turk living among the natives.

Of course the zymotic diseases will corrupt the healthiest climate where an ignorant peasantry delight in breeding contagion, or careless Americans hold public funerals after highly infectious diseases, or are content to use drinking water from their own door-yards, where the water stands on the same level in their privy, well, and cellar.

Some of the points in a four or five years' scrutiny of the Las Vegas American death-rate are of interest. In 1886, 1888, and 1889 there was one American death each year from croupous pneumonia, and none in 1887, and excepting two cases of phthisis, these were the only deaths from any pulmonary disease whatever among resident Americans.

Here it may be observed that bronchitis is rare, and always very mild, capillary bronchitis rarely seen, catarrhal pneumonia uncommon, and, as before stated, not so liable to affect children as at the East. Emphysema and asthma apparently never originate here.

The visiting invalids encroach upon our gross death-rate to the extent of from 22 to 56 per cent, nearly all being victims of advanced phthisis. In 1889 two Americans died of consumption not included in these : one a young woman from Missouri, long a sufferer from chronic gastric catarrh and deficient hepatic assimilation, who escorted here a phthisical relative (a possible case of direct infection) ; the other an old United States pensioner sadly broken with poverty and excess of opium and alcohol. These are rare examples of Ameri-

cans developing phthisis in this country under any circumstances.

Our resident American death-rate fluctuates from 6 to 12 per 1000; in 1888, when we had an unusual number of deaths from chronic disorders in elderly persons, as cancer, heart disease, alcoholism, besides reported old age, the rate reached 10 per 1000, in 1886 typhoid-fever and other zymotics ran it up to 12, in 1887 and 1889 it was 6 per 1000. But in a certain series of years 18 per cent of resident American deaths were from violence, as railroad accidents, suicides, accidental shooting, lightning, and mishaps with horses. No death was reported in these years from Bright's disease.

It must not be supposed that the Mexicans in their experience also accentuate the salubrity of the climate. Excepting a few of the better classes, an ill-fed, ignorant, shiftless race, with gross neglect of all sanitary rules or customs, their resisting power to disease is very feeble. A Spanish physician of nice culture, well skilled in physic, living in Las Vegas, kindly handed me his death list for the last year and a half, and it reached the startling figure of 48, and yet there are other physicians serving the natives, and many die having seen no physician. An American practitioner would think his labors most unfortunate were he to have a half dozen deaths in 18 months. About one-third of the Spanish doctors' deaths were attributed to various pulmonary disorders, another third to diphtheria, the mortality, however, reflecting no discredit on his ability. In 1886 I made a special scrutiny of the Mexican death-rate, finding it 20⅔ per 1000, with a certainty that it was an underestimate, one-third of the dead being children under two years of age!

Wishing to avoid seeming recklessly to laud our climate, let me mention now what presents itself to me as the most serious disadvantage one encounters, say in Las Vegas, where length of residence and numbers of people enable me to speak with greater information and perhaps give some answer to the oft-put and embarrassing question: "What are your prevailing diseases?" I refer to the gastric and hepatic derangements which occur in frequency decidedly beyond any other class of functional disorders, though, unfortunately, not as regularly recognized by physicians as their current importance demands.

Attacks of acute gastric indigestion are very common at all seasons; chronic gastric catarrh is unpleasantly frequent; and fairly numerous are cases of disorder of the liver marked by enlargement, tenderness, and some fever, perhaps only a hyperæmia, due to portal congestion, occurring certainly oftener in well-cared-for women than in men, or even in those men given to alcohol. These hepatic seizures seem readily amenable to treatment and to leave no trace.

But more conspicuous than these, and perhaps really at the origin of them, is the very prevalent lithæmia. Not unfamiliar all along these mountains, it is remarkably prevalent in my community, notably among women in middle life, but occurring also among men, though less often because of greater activity and larger proportion of nitrogenous food. It has been very imperfectly recognized, and even physicians are seriously at fault, for not infrequently whole families are sent away at sacrifice to themselves and loss to the community, because of supposed inevitable pernicious effect of the altitude on wife or mother. Now this is needless, for moderate restriction in the use of carbo-hydrates and a more diligent pursuit of exercise for body and mind by out-door life, by more attention to the pleasures of society, or those varied philanthropic avocations in which woman shines—these promoters of metabolism will suffice to detain among us in comfort and usefulness those persons, generally of the better class, now so often permitted to emigrate.

Restricted diet is essential, for I have seen a hard-riding, vigorous young cattleman suffer severely from lithæmia, daily fearing sudden death in the saddle, attributing his woes to the altitude, his abundant exercise failing to compensate the over-tasked liver as it staggered before the stacks of half-cooked griddle cakes buried in molasses and washed down by a deluge of strong, oversweetened coffee, that served in lieu of a breakfast. Reform in his diet, with simple medication, effected a cure, soon, however, undone by a contemptuous return to the excess of carbo-hydrates, and, wailing over the baleful effects of the altitude he returned to his Eastern home.

These lithæmic conditions appear to be detrimental only as they temporarily embarrass the patient, though the books refer to ensuing degenerations of the arterial walls, etc.

Genuine articular gout has occurred in a number of these cases, with all typical symptoms, an indication, perhaps, that the gouty should not resort to this region.

There is good reason to believe that users of tobacco, coffee, and alcohol in this climate sooner reach a limit where pernicious effects arise ; and many of my patients have had relief from exalted nervousness or retarded tissue metamorphosis by partial or total abstinence from these drugs.

I am pretty sure that we have rather more cases of irritability of the neck of the bladder, not due to grave lesions, easily provoked by sundry causes, based probably on a lithæmic diathesis.

Much success has not attended my efforts to find a reason for this endemic defective metabolism. Whether an excess of sulphate of lime in the water, or some rarer alkali, as lithium, caesium, rubidium, might be present ; whether the larger loss of water through the skin leaving the tissues too dry for free metamorphosis—and Niemeyer said that the only local condition noticed in autopsies after muscular rheumatism—a purely lithæmic state, I believe—was a diminished portion of moisture in the tissues ; or, whether the new-comer in the higher altitude by being at first compelled to breathe more frequently and deeply, thus compensates for the deficiency of oxygen in the attenuated air, while later his respirations resume their former infrequency and shallowness—as I know they do—so reducing the supply of oxygen to the blood, and hampering metamorphosis—whether any of these suggestions has weight is very doubtful.

Las Vegas stands between the foot-hills and the great Mesa, with hundreds of feet of blue limestone and red and white sandstone beneath it, a tiny thread of a river running briskly through it over a stony bed ; no low or marshy tracts near it ; the adjacent lands treeless except for the evergreen timber on its backing foot-hills. Here we have a climate dry, a wind searching, averaging about as many miles per annum as in Colorado, a sky *generally* clear. August is the cloudy month of the year. Here is no trace of malaria as evidenced by periodicity in febrile attacks. The three cool months when invalids suffer most, January, February, and March, 1888, with a mean temperature for the three months of 37°, and the

rainfall but 1.31 inches, had a mean relative humidity of 43 with a minimum, in March, of 20.

Contrast this with Columbus, O., means for the same months, temperature 32°, rainfall 8.82, relative humidity 69°, or with Albany, N. Y., with the low mean temperature of 22° and the high mean relative humidity of 76, and rainfall of 10¾ inches. At low temperatures a close approximation of the figures for temperature and relative humidity mark a more tolerable atmospheric state for weak lungs and kidneys, or for any diminished vitality.

In a Las Vegas winter the heat and humidity figures generally run together ; in Albany, for the three months, the humidity figure exceeded that of temperature 3½ times, in January quintupled it.

In 1889 the relative humidity figures for the first three months of the year in Los Angeles and Berkeley, Cal., were 80 and 83, though the temperature was higher in proportion.

In keeping with this New Mexican dryness is the common high specific gravity of urine, so active is the elimination of moisture by the skin. The air, acting as a vast sponge, drying the skin by speedy absorption, and, though experimental data are not at hand, I am sure that our daily cutaneous transpiration far exceeds the two pounds allowed by the physiologies.

In life insurance examinations I commonly find the urine ranging from 1024 to 1030 in specific gravity. Visitors from the East have referred to me in alarm the fact of greatly diminished renal excretion. On one occasion on the plains a young soldier, the prey of profound nostalgia, who had sought refuge in the hospital, though presenting but a "mind diseased" to be "ministered to," passed 64 hours without micturition, and then, at my request, extruded 2 or 3 ounces of dark, fœtid urine.

Dryness and brittleness of hair and nails are of daily notice.

Coupling these data of excessive aridity with the conspicuous absence of chronic degenerations of the kidneys, it would seem that our wide plains and the east slopes of these mountains afford a refuge for persons presenting the early evidences of such organic changes, a matter that Dr. Solly and Dr. Wilson have noticed favorably before this association, and Dr. Delafield elsewhere. The warning is wise, however, against

advanced cases coming to considerable altitudes, or those with severe cardiac lesions, though for them there still remains the lower elevation of the equally dry plains. And that I may absolve myself from appearance of undue devotion to the climatic merits of my town or territory, let me say that for a dozen years past I have sung the praises of the dry regions of Western Kansas at elevations of 2500 to 3500 feet, and am fairly satisfied that in that section lies the part of the United States most absolutely favorable to human health.

Our winter cold being associated with such constant dryness might be expected to serve the renal cases more favorably than the damper though warmer climates ; besides, have we not also for winter the equally dry but warmer Mesilla Valley, El Paso, Tucson ?

Certain life insurance reports gave to kidney diseases in all deaths occurring on the Rocky Mountain plateau and Pacific slope, a percentage of but 1.6 against nearly 9 per cent of all deaths occurring in New England, or the same in New York.

It has happened to me but rarely to meet an Eastern invalid seeking relief in my country for suspected incipient Bright's disease, and such have not lingered here.

It is to be regretted that already the same protest is raised against the westward migration of these chronic nephritics that has barred the path to healthful change in so many consumptives. Perhaps their Mecca will lie at the foot of Pike's Peak, where now the wealthiest consumptives seem to flock, while their impecunious brethren seek renewal in Las Vegas.

Finally, let me commend these arid regions of the West not only as a resort for those over whom the disasters of renal decadence or of pulmonary tubercular involvement are impending, but to those families who, by reason of adverse climatic environment or vicious hereditary or actual increasing debility, perceive a slenderness of constitution in their children, or dread an early prostration by chronic disease of any sort, and who seek relief from the impediments of malaria or excessive moisture.

To these the one time Great American Desert and the mountains named from their rocks offer salubrious homes, where more years of comfort and usefulness lie before their youth, and a better hope of rearing unscathed their children of tender age.

DISCUSSION.

Dr. Fisk: I have listened with considerable interest to the able paper of the reader. I regret that there is not a larger attendance of the members living in high altitudes, to have heard these interesting statistics.

I only have one or two ideas to express in connection with the paper. In the first place, I would like to speak about the renal troubles.

It is a very prevalent idea in Denver that as the perspiration is being taken up by our dry air, and the pores of the skin become plugged more easily, more work is being thrown upon the kidneys, and in consequence of this over-exertion on the part of the kidneys, renal troubles are more frequent. It is an opinion I have heard expressed by older practitioners, and by laymen as well. Unfortunately, I have no statistics to offer in connection with the subject. It is a branch of medicine that I have given a little attention to, however, and in my own practice I have had considerable to do with renal affections.

My experience does not bear out the assertion. Most of the renal complications which I have found existing in Colorado are the result of some previous illness. I have seen more Bright's disease—with casts—arising from scarlet-fever or diphtheria, or from pregnancy, than I have seen arising idiopathically.

I am not inclined to think, from my own experience, that this climate is conducive to such affections.

I have also watched, in connection with my private practice, and with life insurance work, the question of the increased specific gravity. Here again, I cannot bring any figures to bear upon the subject; but my very strong impression does not bear out the testimony of the reader. I am not inclined to think that the urine is of a higher specific gravity here than it is at lower altitudes. It is higher in the summer and lower in the winter, a change which occurs at sea level as well as here.

In reference to the treatment of diabetes, I was formerly inclined to believe that it did not originate here. I remember looking up the subject some years ago, and on inquiry from my fellow-practitioners, I could find reports of but very few cases of diabetes, especially of the sugar kind—diabetes mellitus. I hear more frequently now of such cases than I used to.

I wish it were our good fortune here in Denver to corroborate the doctor's statement with reference to spinal paralysis, especially in children. We have it. I have seen quite a number of cases. Whether it is due to the fact of Denver's being a larger city, and having more cases to draw from, I cannot say, but we have it here.

There is one thing that I wish to say, with reference to lithæmia. I was very much interested in talking with the Vice-President of the Santa Fé Road some time ago, in a statement he made in reference to the cattle coming from the Rocky Mountain region. He said that at the stock-yards in Chicago the butchers could tell the Rocky Mountain animal from the fact that its liver and its kidneys were so healthy; that it was the very rarest thing in the world to find diseased livers or kidneys in cattle coming from the Rocky Mountain region.

Dr. Denison: I am sure we all appreciate the reading of this very excellent paper. So far as my own experience is concerned, with reference to the question of urinal examinations—having considerable experience in examining for life insurance—it has impressed me with the fact that the author's conclusions are correct as to an increase. Exactly as to what that increase of specific gravity is, of course we differ; but I think there is usually from two to four thousandths greater specific gravity in such examinations of healthy persons.

THE EFFECTS OF DRY ATMOSPHERE ON CHRONIC INFLAMMATION OF THE LARYNX AND NARES.

By E. Fletcher Ingals, A.M., M.D., of Chicago, Ill.

In this paper it is my object to invite your attention to a subject upon which, unfortunately, we have little precise information, hoping thereby to elicit a discussion in which the observation of others may help to remove the deficiencies which I am obliged to confess. The views which I shall here express are based on the study of a large number of cases, but I shall make no attempt to present the histories of these cases in substantiation. Most of my patients live in low altitudes, many of which are damp ; though I frequently see patients who live in a high and dry atmosphere.

In trying to analyze these cases I have been unable to decide satisfactorily what particular phases of the disease are benefited and what injured by the dry atmosphere. In the majority, I presume at least four-fifths, dryness of the atmosphere seems beneficial, but in some it is certainly injurious. At first sight it would seem that cases in which there is excessive secretion would be benefited by residence in a dry atmosphere, whereas those suffering from the opposite condition would be injured, but numerous cases attest that this does not follow in all instances : for example, in simple chronic rhinitis, with excessive discharge, we find a given number of patients improved by removal from the shores of large bodies of water inland, but a limited number of cases with the same disease will be benefited by moving from inland districts to the damp climate of the sea-shore, or the borders of our Great Lakes. We find now and then a patient greatly improved by going to a high altitude with a dry atmosphere, but usually catarrhal cases are injured by this change.

The more we see of these diseases, the more we are impressed with the fact that catarrhal inflammations are found

alike in the damp, chilly atmosphere of the sea-shore, or upon the arid plains of Arizona, in the most favored localities of our Southern States, and in the delightful atmosphere of Colorado, though not to the same degree in each section.

We may assume that the inflammatory affections of the nares and larynx are essentially of the same character, and that therefore they will be influenced in a like manner, though in different degrees, by various climatic conditions.

These affections we will therefore class together as catarrhal, excepting in those instances where we use a qualifying phrase, as, for example, tubercular laryngitis.

Usually these catarrhal affections are less frequent in warm climates, therefore, a warm, equable atmosphere would seem best adapted for their prevention or cure. However, in equable climates the air is loaded with moisture, a condition which undoubtedly favors the development and maintenance of certain forms of catarrhal inflammation, yet the opposite condition of dryness also has its disadvantages, for it favors the formation of dust, and allows the air to be laden with various irritating substances which might be absent in the damper atmosphere. As certain impalpable substances in the atmosphere cause asthma, so in some cases similar substances will excite chronic inflammation of the mucous membrane of the upper air-passages. The damp, and often chilly atmosphere of the Atlantic sea-shore, and the sudden changes along the borders of our Great Lakes are peculiarly favorable to the development of this disease. Nevertheless, a considerable number of the cases that come to those of us who practise in these localities have originated inland. We frequently find that a person having developed the disease in any given locality will be relieved of it by a change to some other locality, though the latter may be either dryer or more moist than the original residence. I know many that are afflicted with the disease upon the shores of Lake Michigan, who, upon going but a few miles into the country are at once relieved. I have known those who could not live with comfort on the sea-shore to have but little difficulty upon the shores of our lakes. I have seen those who have attributed their whole trouble to the sudden and severe atmospheric changes on the borders of our Great Lakes to become much worse by residence in an

equable climate. For example, a patient suffering from a moderate degree of hypertrophic rhinitis went from Chicago to Southern California in hopes of obtaining relief, but there he was unable to breathe through the nose at all, and he was compelled to return to Chicago.

With these conflicting facts before us, how can we determine what climate to recommend to our catarrhal patients? We have observed that as a rule they do best in a comparatively dry climate not more than one or two thousand feet above the level of the sea, but there are many exceptions to this. Occasional cases are greatly benefited by a sojourn in high altitudes, and I hope to hear from the physicians of this locality what particular phases of the disease improve in Colorado.

By ascertaining in individual patients the season of the year, and the kind of days when they feel most comfortable, we may often be able to judge of the most suitable climate for them. Yet it frequently happens with these cases, as with asthmatics, that the climate must be tried by each patient for himself in order to determine what atmospheric condition is best suited to his diseases.

Before sending such cases from home we should try faithfully the methods of treatment which have been found most beneficial by expert laryngologists. If these do not succeed we should recommend a dry or moist climate, according to the kind of weather in which the patient feels best—at an altitude of not more than one or two thousand feet above the sea, or even less than this. High altitudes should be tried only incidentally, as they are not apt to prove beneficial.

My observation, which embraces several thousand patients, leads me to the following conclusions :

A dry atmosphere at a comparatively low altitude will generally be found beneficial in the following diseases :

In rhinitis intumescens, which is characterized by intermittent swelling of the tubernated tissues, with obstruction of one or both nares, and the consequent discharges into the throat.

In simple chronic rhinitis, with or without excessive secretions ; providing there is but little irritation of the mucous membrane.

In atropic rhinitis with excessive muco-purulent discharge, with but little tendency to drying.

In such cases of hyperæsthetic rhinitis as improved during the dryer portions of the year. However, most cases of hyperæsthetic rhinitis will be more benefited by an equable climate even though the atmosphere be loaded with moisture.

A high and dry atmosphere is usually prejudicial in rhinitis intumescens and in atrophic and hypertrophic rhinitis, and indeed in all catarrhal affections occurring in patients of nervous temperament. These injurious effects may be ascribed partly to the dryness of the atmosphere, partly to the irritating dust often found in high altitudes, and partly to the effects of the rare atmosphere upon the nervous system which undoubtedly has much to do with the etiology of catarrh.

A high and dry atmosphere may be expected to prove beneficial in cases where there is excessive secretion with little or no nervous irritability ; in some cases due to syphilis, and in exceptional cases of atrophic rhinitis with excessive secretion.

In inflammatory affections of the *larynx* we may expect benefit at a low altitude with a dry atmosphere ; in simple chronic laryngitis, and in some cases of tubercular laryngitis. In the latter, however, I prefer an altitude of from 1500 to 2500 feet, and there is no objection to the atmosphere being impregnated with the odors of pine and fir which the laity consider of so much importance ; but I doubt whether these are of any benefit.

In cases of laryngitis with deficient secretion, or excessive irritability of the mucous membrane, the moist atmosphere of equable climates is generally preferable.

A high and dry atmosphere is usually injurious to persons suffering from chronic laryngitis, but it is beneficial in exceptional cases. My observation, however, does not enable me to decide what cases will be improved by this condition. But it seems probable that benefit would be derived in certain cases of simple laryngitis in phlegmatic patients ; in some cases due to syphilis in which the mucous membrane requires stimulation, and in exceptional cases of tubercular laryngitis, in which the beneficial effects of the atmosphere upon the constitutional disease more than counterbalance its deleterious influence upon the local affection. The latter are most likely

to be found in patients in whom the mucous membrane of the larynx is not very sensitive. In laryngo-pulmonary tuberculosis patients usually do best at an altitude of from 1500 to 2500 feet, in a warm and dry atmosphere, but it is often difficult to determine what is best for them because of the beneficial effects of high altitudes on tuberculosis of the lungs and their baneful effects on the same disease affecting the larynx.

The injurious effects of such an atmosphere on the larynx are often attributed to the dust which it contains, but the explanation is unsatisfactory, for in persons who are continually inhaling much more dust, in planing-mills or machine-shops, the injurious effects are oftener manifested on the lungs than the larynx.

It seems probable that the action of this atmosphere on the mucous membrane of the upper air-passages is not very dissimilar to that of the wind and sun upon the skin unused to exposure.

Owing to its dryness it causes rapid desiccation and destruction of the superficial epithelial cells, with consequent irritation of the subjacent tissues, which in addition to the increased flow of blood to the part, resulting from diminished air pressure, necessarily increase the inflammatory action.

DISCUSSION.

Dr. Atkins: Mr. President, in the absence of my colleagues from New Mexico, I felt rather mortified a few minutes ago in not following the gentleman across the aisle (Dr. Schenck) when he praised our climate. My stronger brethren might have come forward. Yesterday I spoke in favor of our climate, but now I speak on the adverse side. Yesterday I remarked upon the frequency of pharyngitis and superficial tonsillitis, and suggested they probably had a climatic origin, in many instances due to the changes and dry air of the different seasons.

In regard to nasal catarrh and super-pharyngeal catarrh, I find we usually have those cases in New Mexico when we have high winds and an unusual amount of dust. Some of these gentlemen will remember when Lord MacKenzie, some years

ago, travelled over this country, and the citizens asked him to lecture to them, he denominated this disease "the great American disease, the great nasal catarrh," and he said he became satisfied that over the whole continent it was due to dust; he regarding New York as dry and dusty even as compared with London. But I am satisfied that such cases do not do well in New Mexico. I am not sure that many cases originate there, of chronic nasal catarrh, but cases that already exist do not do well; and frequently, in answering letters inquiring whether catarrhal cases should be sent to New Mexico, I have almost universally answered that I would prefer they should not come.

I noticed in our town also a large percentage of mouth-breathers among the children or the quite young persons, and I am entirely at a loss to account for it—whether it strictly originated there; but many of them were born there, and some of them came when they were quite young, and of apparently quite healthy families, and yet it is quite a striking feature to see them in public places with their mouths hanging open; when I have taken their temperature with the thermometer I could not make them close their mouths and breathe through their noses, and I had to transfer the thermometer to the axilla.

I have noticed, in regard to tubercular laryngitis, the few cases I have observed in New Mexico are bad, and I have made the remark that it is hardly desirable for such cases to come there. I don't know as the same prevails in the southern region.

I should recommend to Dr. Ingals and his fellows in the East not to send those cases of rhinitis or super-pharyngeal catarrh to our dry and dusty region.

Dr. Knight: I think it ought to be borne in mind in this stage of our knowledge that these cases of "catarrh" cover a good many different conditions, as Dr. Ingals knows; and in writing his paper he had reference undoubtedly to the catarrhal conditions which were irremediable by operative treatment; but the profession generally have not come to that knowledge. Some cases of so-called catarrh are dependent upon organic lesions, which have the same effect in keeping up the discharge that a stricture of the urethra does in keep-

ing up the chronic discharge there. So that it is not quite fair, perhaps, to consider the effects of climate, except incidentally, upon the symptoms of the patient, until we are quite sure that he has not got some obstructive conditions which can be remedied.

Now, in regard to mouth-breathers, that condition nine times out of ten, I should say, in young children, is due to an hypertrophied adenoid tissue of the vault of the pharynx, the removal of which is usually followed by a complete cure. Once in a while you see a child breathing through the mouth, and having that stupid appearance from enlarged oral tonsils, but it is very rare ; it was formerly attributed to the enlargement of the oral tonsils before we knew much about the pharyngeal tonsil ; nowadays, if we find the pharyngeal tonsil enlarged, its removal will be followed by a cure of mouth-breathing, even if the oral tonsils remain somewhat enlarged.

As far as I have been able to observe the effect of temperature and moisture upon the condition of the mucous membrane, it seems to me that the one obnoxious combination is coldness and moisture ; that the warm, moist climate may be very tolerable, but a cold, moist one is most intolerable. At any rate, it is so in New England, and keeps up the most irritation of the mucous membranes generally.

Dr. Solly : Dr. Ingals has touched on a subject which has interested me very much, but I can't say that I have arrived at any definite conclusions ; but the impressions I have arrived at are about these, leaving out cases of operative interference, which are not in discussion, I suppose. It seems to me that a broad distinction lies between the mucous membrane which is anæmic and that which is hyperæmic, that would tend to hyperæmia locally which is aggravated by a climate such as Colorado. You get an anæmic person, coming with a profuse discharge from the nose and from the pharynx, or a case of catarrhal condition of the larynx, accompanied with more or less tumidity of the tissues, you will find those cases improve generally very markedly.

We find in chronic laryngitis, which accompanies consumption so frequently—I mean that which is not obviously tubercular—they nearly always improve ; the condition of the voice improves, and the throat improves ; and if they have nasal

catarrh, that improves generally, and it is very apt to remain improved even when the general health is failing. My recollection is, even where the cases are going down-hill in other respects, if they once rallied up to a certain extent, they won't begin to lose their voices again, and be in the trouble they were before, as a rule.

But those that have the hyperæmic appearance or tendency to irritability of the mucous membrane find it worse. We find it so in the bronchial membrane ; those cases attended with a considerable cough are not generally suited for treatment here.

Tubercular laryngitis, of course, is a disease that does well literally nowhere ; but they have been superseded by the number of cases where there has been improvement, not where there may have been death from that or from other causes, but where ulcers have failed to heal in the East, they have been treated in the best possible way, and have come out here and yielded to treatment in a remarkable way. But where there is a deposit of tubercles remaining, the ulcerations will break out again, and the patient may die, and usually does die ; but there is the direct local effect of the air so far as we could judge, with the accompanying improvement in health, which would seem to tend to heal them ; and I think the broad line to be drawn is between that type of catarrhal disease which tends to be anæmic and that which tends to be hyperæmic.

Dr. Ingals : I am glad for the suggestion made by Dr. Solly. It has occurred to me frequently ; but, as I say, I have not seen enough cases that have been in high altitudes so I could feel at all certain about it. The paper was designed to refer simply to the effects of climate on these diseases, and not to the methods which are adopted by laryngologists in their treatment of them.

I want, however, specially to emphasize what Dr. Knight said about mouth-breathing, and its cause being, in young children, so very very often a growth in the nasal pharynx. I don't know any one thing that gives me more satisfaction than to cure these little fellows ; and it is done so very speedily, and it makes such a perfect revelation in their general condition, I think physicians ought more generally to recognize it.

THE MODIFICATION OF TUBERCULOSIS BY CLIMATE.—REPORT OF CASES.

By H. A. Johnson, M.D , Chicago, Ill.

That there are many factors influencing the progress and termination of tuberculosis seems to be evident. It is quite certain that many patients improve or recover after making a change of climate who would in all probability have gone steadily downward if they had remained in the locality where the disease first developed.

The reasons for this improvement are probably multiple. It does not seem to depend upon any one element of climate. The mechanical effects of barometric pressure do not furnish a satisfactory explanation. It is not the result of any special range of temperature. It is not moisture or the absence of moisture alone.

We have probably been searching among comparatively unimportant agencies for the solution of the problem. In other words our theories have been mechanical. We shall probably find that climates modify tuberculosis not directly but indirectly—that is, through their influence upon microscopic life in general ; that the reciprocal influences of living organisms, and consequently the conditions favoring or retarding the growth and propagation of microbes furnish in any locality the most satisfactory explanation for the prevalence or absence of tuberculosis.

The experiments of Professor Charles Bouchard, detailed in a memoir published during the present year, the substance of which has been communicated to the tenth International Medical Congress, go far to demonstrate the proposition that in the case of tuberculosis and other infectious diseases, the products—that is, the secretions of the bacillus absorbed into the system, while not producing the disease itself, do produce in some way a diminished resistance to the disease. These experiments also furnish a plausible explanation of the way in which the microbian products act. It was found that the walls of

blood-vessels were constricted by the presence in the blood of these substances, or by their contact with the vessels locally; the result was, however, much more marked when the products were introduced into the circulating blood. By careful and ingenious methods of observation it was demonstrated that this contraction of the vessels prevented the diapedesis of leucocytes, the destroyers of invading germs. The secretions of a simple saprophyte, and of other non-pathogenic forms, may so affect the walls of the vessels as to hold in check the migratory cells until the tubercular or other virulent forms have gained a substantial hold upon the tissues, and by their own secretions are aole to maintain this poisonous influence upon the vascular structures. It is probably in this way that infection intensifies infection, and that among decaying structures the resistance of living organisms to invasion is lessened, and that even though the bacteria of the decaying structures are not themselves pathogenic, their secretions absorbed into the system contract the vessels, and in this way arrest the normal activities and agencies for defence.

As a rule, we shall probably find that where microscopic life in its various forms flourishes, there tuberculosis finds its most yielding victims; where microbic forms are at a minimum there tuberculosis is also at a minimum. On a clean ship on the wide sea, in the midst of a desert, below sea-level, on high, arid plains, on mountain heights, or beneath Arctic skies, wherever, in fact, the conditions favorable for bacterial growth are comparatively wanting, there consumption is not frequent. It is certain that the forms or spores of the bacillus tuberculosis are carried to all these regions. They have their habitat in living organisms. This habitat is present and is subject to attack as in the localities where consumption abounds, but in the absence of the products of other bacteria diapedesis takes place, the leucocytes meet the invaders, and the disease-producing germs are destroyed. It is true, phagocytosis has been much discussed, and by many questioned, but these experiments of Bouchard seem to leave no room for doubt as to the fact.

This demonstration of the relation of microbic forms, other than those specifically connected with the disease, to the development and progress of tuberculosis seems to bring into

logical relation the facts noted by so many competent observers in widely different localities. These localities present great contrasts in temperature, in barometric pressure, in the amount of moisture dissolved in the air, etc., but they all agree in this fact, that bacterial life is at a minimum ; in all these localities the putrefactive processes, the destruction of organized tissues is slow, and for the reason that the microbes, the agents of this destruction, do not flourish.

By the use of disinfectants we are trying to accomplish in our crowded centres of population the death of the microbes and the sterilization of the soil in which they grow.

With all our efforts, however, we cannot reach that measure of success already attained by nature in the terebithinate forests, on the dry plains, on mountains, or on the ocean away from the contaminating influences of decaying animal and vegetable substances.

I beg to present to the Association brief abstracts of twenty-five cases taken from my record books in the order of their entry. They embrace every case which, during about three years, from 1872 to 1875, went to the Western States or Territories, and of which I was able to obtain any subsequent history. It is, as every one knows who has made an effort to do so, very difficult to follow up patients who are migratory in their habits. The numbers might be largely increased if cases of more recent date should be thought desirable. In this series there is not one later than 1875. I have included only cases going to the arid regions, not because they were the only ones who improved or recovered. Patients who went to the South or Southeast, many of them did well. This series does not, therefore, furnish any basis of comparison between the arid and other regions.

Of these twenty-five cases ten recovered. Their histories cover from three to fifteen years, averaging eight years. Eight improved ; six of them very much improved and only two slightly. Seven did not improve ; it is not certain that any were injured.

Some of the cases which improved returned East after a few months, when the disease again became active. In such cases a return to the arid regions did not seem to have the same influence in modifying its course as at the first visit.

It will be observed that a large majority of the patients were males. I presume this fact is to be accounted for by the greater ease with which men travel and accommodate themselves to the rough ways of living in a new country. It is quite possible that the proportion of men to women now, if taken from my own books, would be different.

Number of Case.	Time in West or under Observation.	Unimproved.
4	A few months.	Worse.
7	A few months.	No better.
12	4 months.	No better.
15	3 months.	No better.
17	3 months.	No better.
18	9 months.	No better.
21	One year.	No better.

No. of cases unimproved.....7

Number of Case.	Time in West or under Observation.	Improved.
5	Several months.	Much.
8	One year.	Much.
10	Six months.	Slightly.
14	2½ years.	Much.
16	9 months.	Slightly.
21	2 years.	Much.
22	2 years.	Much.
24	8 months.	Much

No. of cases improved..... 8

Number of Case.	Time in West or under Observation.	Cured.
1	14 years.	Cured.
2	4 years.	Cured.
3	2 years.	Cured.
6	4 years.	Cured.
9	13 years.	Cured.
11	8 years.	Cured.
13	10 years.	Cured.
19	2 years.	Cured.
23	3 years.	Cured.
25	15 years.	Cured.

No. of cases cured.....10

Case No. 1. Male, age 22, clerk; no hereditary history. Deposits in right top; had hemorrhage; went to Colorado and remained there. I saw him fourteen years afterward. In fair health.

Case No. 2. Male, age 43, lawyer; no family history. Had hemorrhage two years before consultation. Deposits in left top. Went to California. Eleven years later saw him. He had quite recovered.

Case No. 3. Male, age 28, office work; no family history; no hemorrhage. Deposits in left top. Went to South Colorado and New Mexico; remained there. Two years later was quite well.

Case No. 4. Male, age 24. Had been hoarse five years after typhoid-fever; not well since. Deposits in left top. No hemorrhage. Went to Colorado; stayed only a few months; worse after coming home. Laryngeal phthisis; doubtful about going to light altitudes. Did not advise it. He went back to Denver. Ten years afterward he came to this region and in a short time began to cough again. He then returned to Denver. Four years later he was in fair health. Within the last few months I have heard from him. Said to be "all right."

Case No. 5. Male, 44, lawyer. No family history. Colds and cough for three years. Deposits in both lungs; cavities in right; no hemorrhages. Went to Colorado and remained several months. Came back very much improved.

Case No. 6. Male, age 32, physician. No family history. One hemorrhage. Deposits in superior right. No cavity. Went to San Diego; lung troubles improved, and after four years was pronounced cured. Subsequently died of intestinal nephritis.

Case No. 7. Male, age 22, merchant. Mother died of consumption; hemorrhage one year before consultation. Deposits in right lung, with moist râles. Pharynx and larynx involved. Went to Colorado. Received no benefit.

Case No. 8. Male, age 36, banker. No family history. Hemorrhage; cough; deposits in right top. Went to Denver, and in one month wrote that he was well. Advised him to stay West, but he came home next year; disease developed, and went to Santa Barbara; gained for a year or more; began to run down, and died five years after first consultation.

Case No. 9. Male, age 22, office work. No history of phthisis. Hemorrhage first symptom that alarmed him. Deposits in right lung. Went to Denver and remained several months; was so much better that he came home; continued fairly well for three years, but spent winters in Southern California. Six years after first consultation he was in good or fair health. Physical signs normal (at time of first examination dulness on right clavicular, infraclavicular, and mam. rgs. Expiration prolonged over the same). Thirteen years after first consultation saw him and examined him again. No change in physical signs during last seven years. In good weight and health, except a slight acute pharyngitis, for which he came to the office.

Case No. 10. Female, age 18. No family history. Cough for several months. No hemorrhage. Deposits in superior half of right lung; no cavity. A few days after examination spat blood. Went to Denver and spent winter. Dr. —— says she is improving. Died about six months later; particulars unknown.

Case No. 11. Male, age 34, lawyer. Father's family asthmatic and consumptive; father asthmatic. No hemorrhage; cough. Deposits in right lung, superior portion. No cavities. Went to Denver. I saw him there eight years later, and he said he was perfectly well.

Case No. 12. Male, age 35, machinist. Some trouble in right side eighteen months; now cavity in right lung. Is on way to California. Died in Los Angeles four months later.

Case No. 13. Female, age 26, housewife. Father died of phthisis. No other members of family or near relatives consumptives. Coughing and shortness of breath. Deposits in right top, and broncho-vesicular breath sounds left top. Went to Western Kansas. Saw her ten years later. Physical signs in right chest about as when first saw her.

Case No. 14. Female, age 27, domestic. Mother died of consumption. Coughing three months or more; cavity in infraclavicular region of right lung. Asked whether she should go home to Ireland, stay here in Chicago, or go to Colorado. Wants to go West. I consented reluctantly, as the progress had been rapid. She went to Colorado, and two and one half years ($2\frac{1}{2}$) afterward learned that she had been in Colorado all

the time after the examination, and was in fair health ; able to do her work as a domestic. Not heard from since.

Case No. 15. Male, age 29, railroad superintendent. No family history of phthisis. Lost thirty pounds in last six months. Dulness at top of left, and slight at top of right, lung. Broncho-vesicular breathing. Epiglottis rough. Pulse frequent (120) ; breathing hurried. Advised Colorado. Went and stayed eight weeks ; cough was dry and troublesome (this was early summer). Physical signs in left chest more marked ; laryngeal symptoms more troublesome ; physical signs. Changed for the worse. In a letter from Colorado Springs, dated July, he says : "In my opinion this country is a humbug of the first water"—a hasty conclusion, certainly, and with such an opinion he could hardly do well in the best of climates.

Case No. 16. Male, age 29, merchant. No family history. Deposits in right top ; no cavity. Advised Denver ; went and stayed three months ; came back better ; gained constantly while there, but immediately began to run down ; voice hoarse, and physical signs soon began to be more marked. Urged him to go back. He went to California—San Francisco, Santa Barbara, and Los Angeles. At first he improved a little, but soon began to fail. In a letter written about six months after going to the Coast, he says : "My intention is to leave here soon and go to Colorado, where I was last summer and improved more than here." He came to Chicago two months later. Examination revealed a marked extension of the lesions ; had lost eight or nine pounds—all that he gained in Colorado. He died in Chicago two months later.

Case No. 17. Male, age 33, clerk. No family history of phthisis. Cough last six months. No hemorrhage. Deposits in tops of both lungs. No cavities. Remained in Chicago six months and then, having grown worse, went to Denver and died there about three months later.

Case No. 18. Male, age 24, attorney. Family consumptive. No hemorrhage. Physical signs indicate deposits in right apex. Three months later went to Denver and remained nine months. He thinks he has held his own, but has not notably gained. I find he has lost five pounds in weight, and that there is a decided extension of the trouble in the right lung. He died in Chicago eight months later.

Case No. 19. Male, age 29, merchant. No family history of lung troubles. No hemorrhage; some cough and hoarseness for last eight months. Deposits in left lung, tubular and gurgling sounds at top; feeble breath sounds at base. He went to Colorado, though the physical signs indicated cavities in the left lung. The right lung was healthy, at least I could discover no evidence of deposits. Two years later he reported that he was fairly well—"in good condition," to use the language of the reporter. Have not heard from him since.

Case No. 20. Male, age 21, telegraph operator. No family history. For some months cough; hemorrhage three years ago. Dulness over left top, above and below clavicle; tubular breath sounds over left apex; broncho-vesicular breath sounds also at right top. Went to Colorado. Two years later he wrote that he had maintained his weight, and able to do business, but still coughed; not heard from since.

Case No. 21. Male, age 21. Just out of college—Yale. Coughing three months. Family history of consumption on mother's side. Hemorrhage. Went to California—Santa Clara Valley—and afterward to Denver. No cavity when he left here. One year later Dr. Bancroft writes that "there is a cavity in apex of right lung." Came back to Chicago, and died four months later.

Case No. 22. Male, age 43, merchant. Family consumptive. Cough for several months. Deposits in right top. Went to Southern California and spent the winter. Came back much better. Spent the next winter in Florida and South Carolina—Aiken. Thought California better than the South. Two years later was in fair health and the physical signs unchanged for the worse. Spent the next two winters in the West on the plains, and held his own; not heard from since.

Case No. 23. Female, age 22. Family history of consumption. Hemorrhage the first symptom to attract attention. Soon afterward found evidence of deposits in the tops of both lungs. She went to Denver and, three years later, wrote that she is fairly well. Has gained in weight and appetite. She says "the climate agrees with me very well."

Case No. 24. Male, age 34, lawyer. Cough several months. Hemorrhage. Evidence of deposits in right top. Advised

him to go to Colorado. Went to New York. Came back and had hemorrhage again. Six months later came for re-examination. Not much change in physical signs. Again advised Colorado. He went to Denver and Colorado Springs and remained there eight months, when he came back much improved; urged him to go back, but he declined. Went to New York, and Dr. A. Clark advised him to go to California on a sailing vessel around the Horn. A letter from him at San Francisco says he did well on the voyage, but not so well in California (San Francisco). Regrets that he did not remain in Colorado. Subsequently came back to Chicago, and died from profuse hemorrhage.

Case No. 25. Male, age 20, railroad clerk. Family consumptive. Cough for several weeks, and has been losing weight. Has night-sweats; dulness and sub-crepitant râles over left lung; no hemorrhage. Went to Colorado and improved. Came back after a few months and went to Massachusetts. Cough returned.

THE CLIMATE OF AJACCIO.

By A. Tucker Wise, M.D., of Maloja, Switzerland.

The best qualification for any physician recommending a patient to leave his home for a foreign health-resort is, that the adviser has himself lived in the health-station he recommends. By this ounce of experience, which is worth a pound of theory, or gleanings from other sources, a true estimate can be made of the drawbacks and advantages of climatic treatment.

From my own experience, in practice on the Continent, I find that the most discontented persons are those who have never had the disadvantages of foreign travel and foreign residence clearly set before them, but have relied mostly on the glowing advertisements of blue sky and sunshine everywhere, of which one reads, while the winter sunshine of the Riviera, for example, can be totalled up in hundreds of hours, with the object of outstripping some rival resort, any resident knows of from personal experience in these beautiful climates; insomuch that no invalid can safely venture out of doors before 9.30 or 10 A.M., owing to the chilly morning air and the heavy dews which lie wet on the pavements, even on the pavements of the towns along the Mediterranean shore. And the most treacherous and dangerous part of the day is that preceding sundown, when the loss of heat by terrestrial radiation is so rapid that delicate persons should be indoors long before the sun dips below the horizon.

At the beginning of last winter, I was induced to visit Ajaccio, having had that winter station highly recommended to me, and from the literature on health resorts at my disposal I found glowing accounts of Corsica Island, of which Ajaccio is the principal town, having a population of 20,000, situated at the central border of a beautiful and well-protected bay opening to the southwest. It lies on a parallel with the southern part of Wyoming, but, as we shall presently see, has not the slightest resemblance to the climate of any inland place.

Fifteen to twenty miles in the rear of Ajaccio is a semi-circular mountain-chain of granitic formation sloping down to undulating foot-hills, and presenting a glowing panorama at sundown. During the winter season the distant peaks of Monte Cinto, Rotondo, and d'Oro are capped with snow, and the chilly northeast wind over the Gulf of Genoa is dried and broken in force before it reaches the western shore, where it is again arrested near Ajaccio by the sheltering hills surrounding the town. The visitors' quarter is away from the business part of the town, along the Cours Grandval, and begins a gentle slope at the Hotel Continental to the Place Casone, the military parade ground. Beyond this, stretching away toward Point Parata, are the fertile and picturesque slopes of Barbacaja and Vignola, dotted here and there with orange-groves, vineyards, olives, and the prickly pear. The only blot on this fair landscape is a cemetery of huge proportions scattered over with mausoleums. Nearly every family of any importance, or that wishes to be considered so, builds a "chapelle" wherein to bury their dead. These solid structures form a striking feature on entering the Bay of Ajaccio. They are not all limited to the cemetery and its neighborhood, but some are perched here and there among the olive-groves, occupying the choicest building sites in the vicinity.

It is impossible to mention Ajaccio without referring to the wonderful fortunes of the Bonaparte family. The father, a notary, occupied a good social position in the town. He spent his time chiefly in carrying on lawsuits against the Jesuits of Ajaccio, with the object of obtaining a disputed estate for his large family (five of whom died young), caused him some anxiety as to their future. Undreamed of destinies! Napoleon, the second-born, becomes the greatest general of all time, and the remaining seven children count four kings among them, one queen, and two princesses. The house in which Napoleon was born is preserved as a curiosity, and the memory of the Corsican's personality is never lost while one resides in Ajaccio, but is constantly freshened by relics and remembrances of the illustrious soldier's early days.

The soil at Ajaccio is disintegrated granite, and allows a rapid disappearance of the heavy showers which fall during autumn. But, unlike the Riviera, little rain falls in March.

Rows of orange trees are seen as boulevards in the town, covered in November with fruit, and during spring, when full of blossom, contrast strangely with the malodorous and dirty streets. The gardens are filled with luxuriant vegetation. Bananas, the delicate carouba tree, a few palms, oranges, lemons, a variety of cacti, and the castor-oil plant; the prickly pear, aloe, fig, and olive grow everywhere. Many eucalyptus trees have been planted, with a view to affording an antidote to the miasms which exist in the low-lying and damp localities during summer time. These trees grow rapidly, and furnish a useful wood for household purposes, as well as being graceful and ornamental. Along the Cours Grandval some flourishing plane trees form a boulevard, and remain green well into the month of December.

Inland, at elevations of 2000 feet, the olive gives place to the chestnut tree. The chestnut is looked upon by the indolent native as the most important production of the country, requiring little labor and attention, and affording a ready means of subsistence. The chestnuts are dried by heat, and when wanted are ground into flour to make a species of cake. Above 3000 feet are beeches and oaks, and higher still the juniper and pine.

The first range of hills surrounding Ajaccio is from 1500 to 2000 feet above the sea, and about three miles distant. The hills are all primary granitic formation, and are part of the jagged, irregular chain which traverses the island from north to south on its western half. On the eastern side a range runs from north to south of calcareous rocks; these have been washed down in past ages, forming sloping alluvial plains, which get overflowed by the sea. The burning summer sun and decaying vegetation give rise to the most deadly malaria, and render the lower levels near the sea quite uninhabitable during summer time. Although this is not the case near Ajaccio, malarial-fevers are frequent in hot weather, even in the town itself.

The water-supply is of a pure and fairly soft quality, brought to the town from Carazzi, twelve miles distant, by the Gravond Canal. Owing to the wholesomeness of this water, and, in part, to the peculiarity of the soil, Corsica has experienced a remarkable immunity from cholera epidemics. The binding

action of rain on the calcareous granite used as pavement for the roads, and the weight of this material, prevents the roads becoming dusty, even during dry weather. After rain, too, there is surprisingly little inconvenience from mud, for all the heavy dust consolidates into a sort of mortar and necessitates but little labor for road cleaning. The porosity of the subsoil accounts for the rapid disappearance of moisture after rain, when the sun may shine out clear, and the roads be quite dry in half an hour.

Stormy days in autumn are common, and, with cutting westerly winds and heavy showers, are very chilling in a temperature of 48° and 50° F. A slight tinge of north in these storms gives the mistral characteristics so well known on the Riviera, but the occurrence of the true Riviera mistral is very rare in Ajaccio. This exemption constitutes one of the important points in the climate, and makes the place compare favorably with the mainland stations, where the mistral is the dreaded wind, especially at Nice.

The term "libeccio" is given to a southwest moist wind, and the southeast wind goes by the name "sirocco." All these currents produce different and marked effects. The sirocco is warm, first dry and then wet. It resembles the föhn in the high Alps of Switzerland, but is, of course, much higher in temperature; the effects on the body, however, are almost identical, producing depression of spirits, loss of appetite, and sleeplessness, and causing feverish symptoms in pulmonary cases. The "libeccio," on the other hand, is a temperate and soft wind, with genial bright weather, and prevails as a high current throughout the greater part of winter, and in spring its continuance for a prolonged period is almost a certainty.

The mean temperature during winter is about 55° F., with a limited range, rarely exceeding 10° F. day temperature for a whole winter. On an average, the minimum thermometer falls to freezing point once in a winter, but with this degree of morning cold the day may be bright, warm, and pleasant.

The average number of rainy days is thirty for the season, and the relative humidity 82°.

From my own personal point of view, I regard Ajaccio as the most comfortable climate I have ever visited, with the exception of the winters in the Bermudas, and, in comparison

with Madeira, it is certainly more bracing and agreeable to the able-bodied.

The climate can be described as a soft, temperate climate, more sedative than any part along the Riviera, and although liable to variations in temperature, these are not so pronounced as at Nice and Cannes, or even Mentone and San Remo. Ajaccio ranks between Madeira and the Italian Riviera, but is warmer than the latter and more equable. Every visitor is struck by the marked absence of wind and dust. These pleasant conditions permit of walking exercise or "sitting out" with any one in delicate health, but as there is a sudden fall of temperature at 4 o'clock or 4.30, similar to that on the Riviera, although not so pronounced, it is advisable for all invalids to seek the shelter of the house about this time.

The cases most suitable and likely to be benefited by a winter's residence are lung affection, with high temperatures and nervous irritability, especially the erethistic form of phthisis, for which Alpine heights are so unsuitable.

The phthisis of advanced life, with cardiac feebleness, where the powers of resistance to cold are at a low ebb, or there is much emphysema, with cold, livid extremities--the class of invalids killed in Europe by mountain air.

Disease of the lungs, where the breathing powers are greatly diminished, or where a stubborn cough is a prominent symptom.

Gouty subjects appear to be more free from acute attacks of this disease than elsewhere, and eczema gives less trouble and inconvenience.

Scrofulous affections of young children.

Nervous, pulmonary, or cardiac diseases requiring a soothing influence, chronic bronchitis, asthma, Bright's disease. Debility and anæmia of advanced life. Laryngitis and catarrhal affections.

The drawbacks of Ajaccio. Any one who thinks of going to Corsica must not fall into the error of supposing that hotel accommodation equals in style, food, and comfort the luxurious houses on the Riviera, or the advantages of more fully developed health stations. Life in Ajaccio is of a quiet, unpretending mode, free from excitement, and rather dull in amusements—a strict counterpart of the climatic feature—unparalleled calmness.

Should the proposed scheme of building a good hotel, with a garden, etc., ever be carried out, a prosperous future lies before Ajaccio, if only by reason of its comparative freedom from the mistral. Up to the present time enthusiastic writers have rather damaged the place than otherwise by creating exaggerated expectation in the minds of intending visitors. This error inevitably leads to disappointment everywhere, and leaves a place with a debased reputation each season.

The means of communication with the Continent are quite second-rate, and the fare very high for the poor accommodation offered.

The drainage of Ajaccio is certainly not perfect, but zymotic diseases are very uncommon.

There is one point I should wish to refer to concerning not only the houses in Ajaccio, but those along the Riviera as well. For economical reasons, brick tiles are adopted as flooring in many of the hotels. This is a most unhealthful and pernicious system of architecture, for the floors so constructed strike a chill to the lower extremities, and by the radiation of heat from the person to the colder pavement, produce rheumatic pains of the ankles and knees, pharyngitis, and enlarged tonsils. I am not sure if the prevalence of scrofulous corneitis, and a granular condition of the eyelids, so common in Ajaccio, is not dependent in some indirect manner upon the dampness and chill of the tiled floors in use in all the houses of the town, even to the topmost bedroom. It is a condition which, in cool or rainy weather, is so chilling to the feet, even with carpets, that chilblains are produced.

The chief diseases of the natives are scrofula, intermittent-fevers, articular and muscular rheumatism, and phthisis, which the inhabitants of the towns do not escape.

With respect to cleanliness, there is nothing to complain of in the hotels, but the town itself is one of the dirtiest. The authorities are most anxious in sentiment to attract visitors, but in action they do nothing, so one of the best European climates is lost to invalids. Its only title now to the fame of a health-resort lies in the climate solely. Invalids, however, cannot live on climate alone.

I cannot close these remarks without referring to the delightful excursions that can be made at the end of winter, or

during the spring, to the interior parts of the island. Contrary to many reports, travelling is perfectly safe, and obliging natives are encountered wherever a stoppage is made. The murderous vendetta, of which one hears always, is still carried on throughout the country, in spite of all steps taken for its repression. A feud between two families sometimes ends in a series of murders extending over years, until only one individual is left. In spite of this savage blot on the Corsican character, the natives themselves are kind and well disposed toward strangers ; hospitality is offered frequently without expectation of any pecuniary gain.

Corsica is an Italian island, but has belonged to France since 1768.

OCEAN CLIMATE.

By M. CHARTERIS, M.D., of Glasgow, Scotland.

THE therapeutic considerations of most importance in a change of climate undoubtedly are, (1st) pure air, free from dust and organic particles ; (2d) abundance of sunshine ; (3d) equability of temperature ; (4th) absence of very hot and very cold winds, or at least only a short duration of these.

These four elements should be present in each of the subdivisions of climate which a therapeutic classification renders necessary—viz., of the seaside, the mountains, the inland woodland districts, and the open sea.

It is not my intention to speak of the first three mentioned, but to confine my attention to the last one, with which from many circumstances I am most familiar.

In doing this I shall, first of all, point out some of the great advantages of a sea-voyage and then make a few comments upon the drawbacks, the hardships, or disadvantages, which are certainly with some truth made against it.

ADVANTAGES.—The air of the sea is absolutely pure on deck where, in fine weather, the greater portion of the day is spent. It is also equable. Sudden changes of temperature upon the high seas are very rare, and no chill is felt at sundown. This equability is not depressing, for the constant prevalence of refreshing breezes, laden with saline particles in suspension, renders it a valuable and most invigorating tonic.

Granted, then, that we have an atmosphere pure and equable, great advantages in many diseases may be predicated from a sea-voyage carefully selected and of considerable length.

But before recommending its adoption certain idiosyncrasies have to be considered, the chief of these being sea-sickness. For this we have no specific, although careful dieting before and after sailing do much, in many cases, to prevent its occurrence. A person fond of the pleasures of the table, and who has taken a hearty meal before or after leaving land, will

invariably succumb for a longer or shorter period, and in his despondency audibly and volubly declaim upon the hardships of the sea. He forgets that he is simply paying the penalty of disregarding dietetic rules, and that the sea, like a stern parent, is inflicting upon him the punishment he deserves.

But we must remember that errors of diet will not alone account for sea-sickness—some stand the sea well, some badly; and it is a prudent step to advise any one for whom we consider a sea-voyage desirable to take a short experimental trip in a coasting steamer, and from it to judge of his or her fitness to undertake a long voyage. If this test should be unsatisfactory, if there be great prostration and timidity, a long voyage would only accentuate evil and do more harm than good; but if there be complete immunity from, or only very little sickness, then the advisability of the voyage is so far secured.

The next point is to consider the time of the year suitable for starting. The proper time for leaving Great Britain is at the beginning of October, and the return voyage should be so arranged that the arrival home should be about the middle of April. Certain companies of steam or sailing vessels afford considerable facilities for carrying out the objects in view, and grant return tickets at reduced rates to Melbourne or Sydney. On the arrival of the steamer at either port, it is not advisable for the patient to remain in town, on account of the heat and the dust storms prevailing at this time of the year, but rather to proceed to Tasmania, or the Riverina of New South Wales, or the Darling Downs of Queensland. Amid delightful surroundings, a few weeks can thus be profitably and pleasantly spent, with little risk of undoing the good of the outward voyage which the homeward trip is intended to consolidate.

On returning in the middle of February there is little chance of unfavorable winds or prolonged fogs, if the route selected is by the Cape of Good Hope or by the Red Sea by way of the Suez Canal and the Mediterranean, or to San Francisco, thence to New York and home.

On the outward voyage the invalid must expect about twenty wet days. The temperatures met with range from 40° to 80° F. The coldest and, perhaps, the most uncertain weather occurring in the North Atlantic or South Pacific Ocean.

CHOICE OF A VESSEL.—The following considerations may be useful in deciding between steam and sailing vessels:

FOR A STEAMER.—As the steamer is not seriously hampered by adverse winds or bad weather, the length of the voyage may be fairly and accurately predicted, and this fact saves much anxiety on the part of friends at home.

AGAINST STEAMERS are the ceaseless reverberations of the screw propeller, the discomforts of steam and smoke on deck, the bad odors from the engine-room, and the shipping of seas when head winds prevail.

FOR SAILING VESSELS there are the advantages of no bad odors, of more roomy and airy cabins, while the lazy motion permits daily exercise on deck.

AGAINST SAILING VESSELS are the fewer number of passengers, the longer and more uncertain duration of the voyage, and the probability of being becalmed for days or weeks at the Equator in a humid, depressing atmosphere of 80° to 85° F.

It is advisable, in making preparations for a long voyage, to remember that the steamer or ship's library is scanty and contains, as a rule, old and well-thumbed books. It is well, therefore, before leaving, to purchase a good supply of light literature, by the reading of which time may be beguiled. It is also indispensable to provide rugs, cushions, a deck-chair, a waterproof suit, and a sponge bath. Thus provided, life on board of a good going steamer proceeds easily and smoothly. There is little friction among the passengers, and each one tries to enjoy the voyage and to find enjoyment for others. Friendships are formed which stand the test of after years, and various deck amusements, as quoits and shuffle-board, wean the invalid from brooding on his own ailments.

For the man who is not seriously ill, but merely run down by overwork, professional or mercantile, a sea-voyage offers an unequalled holiday, and the rest which it gives to the nervous system is nature's antidote to the great or little worries which at times harass and embitter life. His routine existence is changed—no telegram can arrive, no bill has to be met, no duns can harass, and no proof-sheets have to be corrected. Thus, in a trip in the autumn to the United States, by a steamer not too fast or too crowded, he is wooed by the breezes of the Atlantic, and a new physique seems to be acquired, and many fancied and real ailments disappear under a tonic which art can never supply.

DISADVANTAGES.—The disadvantages of a sea-voyage have been depicted by some in gloomy colors, more especially with regard to ventilation and cooking. The evils arising from overcrowding and bad ventilation cannot be extenuated, and no invalid should proceed to sea unless he can be assured of having a roomy cabin to himself, and that the vessel shall possess a well-equipped hospital which is under the care of an experienced and trustworthy surgeon. Complete isolation of the very sick can thus be secured should any one turn seriously ill, or should an infectious disease arise shortly after leaving port.

The question of cooking does not present a formidable obstacle. Persons who expect an invalid dietary should not be counselled to go to sea. They should remain on shore and try some other modes of treatment. To the majority of persons the ship's fare offers wholesome solid food, and in most cases digestion and appetite go together. There is a greater risk from eating too much than too little, and the crowding of meals should be avoided. A substantial breakfast and a good dinner are amply sufficient for nature's wants, with the addition of a biscuit or two before turning in. I may summarize my views by stating that benefit may be derived from an ocean climate in persons suffering from nervous exhaustion and overwork, in impaired convalescence from an acute disease, and in diseases of bones and joints. To these may be added the early stage of hereditary phthisis, especially in a young person. There can be little doubt of the good effected in such instances by a sea-voyage carefully selected and of considerable length. The recuperative powers of nature are aided by exceptional advantages. Weight, if lost, is regained, and the tubercular mischief, as a rule, is permanently arrested. If the disease be advanced to the second stage, all experience testifies that degeneration proceeds more rapidly on sea than on shore, and that the patient, if he reaches land only does this to find a grave far away from the surroundings of friends and home. No matter how anxiously the patient may crave for the trial of an ocean-voyage, his entreaties should be countermanded by the inflexible decision of his medical adviser couched in the kindest but most telling manner. In such cases you may say, *non mutant morbum qui transeunt mare*, and the

same adage may be applied to cases of organic heart disease, to epilepsy, to enlargements of the liver, and to nervous affections associated with despondency or melancholia.

In conclusion, I venture to give a practical suggestion which would minimize some of the objections offered to a sea-voyage. The suggestion is not original, but came out in speaking of these with a distinguished London physician :

"In the future, a steamer suitable as a sanatorium may be so fitted up that it could accommodate easily from one hundred to two hundred invalids, and convey them from place to place independently of the exigencies of time, or even weather. Such a boon would be welcomed by many who cannot spend the winter in this country, and yet dread the cold journey and the cramped surroundings of Alpine health-resorts, and the treacherous mistral of the Riviera. The boon would be enhanced by the knowledge that the invalids would be looked after by a competent English-speaking physician cognizant of their habits and their idiosyncrasies, and who would carry out other therapeutic measures to aid the influence of pure air and an equable climate."

REMARKS ON OCEAN CLIMATE.

By Dr. W. E. Fisher, Pacific Mail S.S. Co., San Francisco.

It would seem, in reviewing Dr. Charteris's suggestions, that they are referable more to an ocean-voyage made from the British Isles, and would be of more practical advantage to patients resident in the British Isles and nearer the port from whence the voyage is to be taken. To American physicians, the question of importance is to obtain, as Dr. Charteris states, an ocean-voyage with an equable temperature and freedom from high winds nearer home. After quite an extended experience with the Pacific Mail Steamship Co., as surgeon, I am inclined to believe the proneness to sea-sickness is greatly exaggerated, for the following reasons :

1. Patients afflicted with chronic diseases, such as phthisis, dyspepsia, gastric catarrh, etc., are seldom if ever subject to sea-sickness.

2. After the first two days at sea it is rare to find any one sea-sick. The recovery is usually prompt, and the after benefit great. And right at this point I would like to enter a protest. Many of the leading physicians of our larger Eastern cities—namely, New York, Boston, and Philadelphia, are accustomed to send patients every winter to California via the Isthmus of Panama, and it seems to me that they do so without sufficiently acquainting themselves with the character of the climate through which their patients must pass. For a number of years past I have met patients on the steamers from New York to San Francisco, sent by eminent physicians, among whom I might mention Drs. Fordyce Barker, Sands, John T. Metcalfe, of New York; Dr. Bartholow, of Philadelphia—a large percentage of whom stand such a sea-voyage badly. I am speaking now of cases of phthisis—second and third stages.

Many of our Eastern physicians imagine that the trip above-mentioned is a balmy, delightful one for invalids during the winter months. Let us see how it is in reality.

On leaving New York, for the first few days, or, rather, until the Bahama Islands are reached, the invalid experiences fairly bracing weather. From that point to Aspinwall, and thence up the Pacific Coast, during the long twenty-four or twenty-five days' voyage, a distance of nearly three thousand miles, the temperature averages 100° in the shade, and many days rises as high as 105° or 106°. This is during our winter months in the United States, and it is but just to say that many die on the voyage, or succumb almost immediately on their arrival on the Californian coast. A record of several hundred invalids, with advanced phthisis, who have made this sea-voyage, shows a mortality of between 60 and 70 per cent. It would thus seem that physicians should inform themselves thoroughly on the ocean climate through which they are about to send their patients. But while the above-mentioned voyage is not a desirable one for phthisical patients, there are many voyages from different points in the United States which are desirable and beneficial. The voyage from New York to the

Bahamas, a short, four-days' voyage, is a good one. The voyage from San Francisco to the Sandwich Islands, a seven-days' voyage by steamer, or twelve to fourteen days by sailing vessel, is one of equable temperature and freedom from high winds, and is especially suitable to such cases. The same may be said of the summer voyage from San Francisco to Japan, a sea-voyage of sixteen to seventeen days, in the great majority of which voyages calm, smooth seas prevail.

And now, while on the subject of sea-voyages, let me emphasize one of Dr. Charteris's points in regard to dietary.

Never send a patient to sea who is compelled to live on a limited diet, unless he can take the requisite food along with him, a ship being the poorest place in the world where to obtain any special article of diet. More ground will be lost by patients under such circumstances in one week than can possibly be regained in many months following, on shore, even under the most favorable conditions. There cannot be the slightest doubt in the world that a sea-voyage may be, and is, beneficial in a great majority of chronic cases, but it should be a voyage chosen for its especial adaptability to the case in question, and the climate, class of steamers, food, etc., should have the careful consideration of the family physician before he sends his patient on a month's voyage by water, for a lack of information on the physician's part may mean improvement to the patient, and may mean death, whereas positive knowledge would insure improvement.

THE CLIMATE OF NEW MEXICO AS VIEWED BY THE MEDICAL FRATERNITY THERE.

By Dr. James H. Worth, Albuquerque, N. M.

When I received a communication from the President of this Association, requesting an article upon the climate of New Mexico, the task seemed well-nigh a hopeless one, for the reason that the territory has been largely a blank as far as climatological observations are concerned. Although the oldest settled province of the United States, it was largely a *terra incognito* until the completion of the railroads through its borders, within the last twelve years, rendered it accessible to the rest of the country.

Prior to 1878 meteorological observations were made at the various army posts within the borders, but the abandonment of these, temporarily or permanently, have rendered their tables of but slight importance, and the rush and bustle incident upon the occupancy of a new country have thrown into the background such luxuries of scientific research.

Within the last three years new stations, mainly kept up by the gratuitous service of interested citizens, have been added to the few old ones, and it is to be hoped that within a few years data upon which to base more accurate knowledge will be in our possession. Due gratitude must, however, be shown to the few isolated observers, scattered here and there through the territory, who have enabled us to have a foundation upon which to build, but owing to the interrupted character of these observations it becomes necessary to seek another source of information—viz., the medical practitioner himself and his opinion of the results obtained by watching cases come and go.

For years past New Mexico and Arizona have been recommended as a climate for diseases of the chest ; and with the usual liberality of the laity, for all forms and varieties—in fact, for anything that suggested the term "Lung Affection."

Many came and were benefited, but the journey was long, tedious, and uncomfortable; living was expensive and even then none too good; other places were easier of access and were sought in preference; but now all this is changed; the journey is easily and cheaply made, good hotels are the rule, and the tide of restless health-seekers, in quest of the lost fountain of youth have their eyes turned toward New Mexico, remembering the reports of old and imagining more than the reality.

Twelve years have elapsed since the railroads came, and now let us hear what the practitioner has to say regarding those who have come here. And just here let me say that, as in all emigrations, it is largely the poor and the middle classes who have so far reached New Mexico. The well-to-do and rich are still seeking the comforts that an old established civilization has evolved, and their aim has been to combine with these comforts a climate suitable for their needs. To attain this end they have ransacked Europe, Africa, and America, but up to now New Mexico has deterred them by being unfortunately a "new country."

In view of this the doctors can have their say without any imputation of desiring to "boom" the country. The cases up to date being largely those who, while seeking the country for its climatic conditions have had to depend upon it also for an actual livelihood, and hence, giving it a much more severe test than mere health seeking.

Lying upon the southeastern slope of the Rocky Mountain plateau, New Mexico may be irregularly divided into three districts, an elevated treeless plain to the east, a mountain plateau to the west, and a river valley lying between. Its chief characteristic, modified by local condition, being the dryness of the air. Scattered through these three divisions at widely separated stations are located the physicians from whose reports this article has been made up.

In the circular sent to each, and in addition to the questions relative to population, climate, etc., special stress was laid upon the following questions, viz.:

1. Liability of the native population to phthisis and its fatality.

2. Liability of Americans born in the territory to phthisis.

3. Effect of the climate upon tubercular cases in which no loss of living tissue has occurred.

4. Probability of being able to resume former climate and living.

5. Effect of climate upon similar cases, but in which softening has occurred.

6. What unfavorable conditions exist bearing upon the phthisical?

Naturally the effects of a climate are best seen among the native population, and practice among them soon demonstrates the non-existence of phthisis, which becomes the more marked when we consider their habits of life, their total disregard of any care, and their social condition. In forty returns but four reporters mention cases of phthisis occurring in native population, and in many of these there has been a history of infection.

Four cases occurred in women either wives of or cohabiting with phthisical Americans, and of the others no definite information can be obtained beyond the fact that the cases were not above the suspicion of a specific taint.

The only case of my own was well marked, fatal as to issue, but, occurring in a common prostitute, other causes can be assigned.

One reporter practising twenty-two years sends in three cases, another practising thirteen years sends the same number. And the total number sent in by forty observers amounts to fourteen cases, the course of which in no way differed from that of phthisis among Americans.

In view of the fact that the majority of these cases occurred in towns, and as the statements of the reporters show, mainly in cases where the moral element was decidedly wanting, the probability of infection may be strongly urged.

2. No cases of phthisis occurring among Americans born in the territory have been reported.

As many of the children born of parents who came here in the early days have now reached manhood, and as many of these parents came to New Mexico "for their health," this fact is significant.

3. In such cases when tubercular taint exists, but where no loss of lung tissue has taken place, there is a unanimity of

opinion that the disease has uniformly been checked, and, as far as can be done, in some instances cured. At all events the entire feeling of the profession is that of general, decided, and lasting benefit. The expectancy of life is largely increased and the actions of life more readily performed by reason of the increased vitality and consequent suppression of the symptoms of the disease. In the majority of cases a total cessation of the trouble is seen, and to such an extent as almost to warrant the statement of cure.

Regarding the possibility of a return of a patient to his former home and life, the general opinion is one of disfavor. Some restrict this privilege to certain classes, while others discourage it entirely. While unwilling to deny the possibility of some cases returning home, the feeling runs through all the answers that it would be taking an unnecessary risk.

Regarding the fifth inquiry, the results obtained from cases in which loss of lung tissue has occurred seem to indicate a belief that progress is in direct proportion to the amount of lung tissue destroyed, although the effect of high temperature, heart affections, and an excitable nervous system in connection with a moderate loss of lung substance have not been overlooked in the replies.

Physical examination has shown that cavities have cicatrized, and even considerable loss of lung tissue has been compensated, and that when the preceding complications can be excluded that the patient will do well, provided he be able to live largely out-doors. This depends upon the effort he himself makes, as there exists no climatic reason for not so doing.

Softening with hemorrhage is not itself a contraindication, unless accompanied by a marked hemorrhagic diathesis; in fact, some of the cases in which the best results were obtained have been those whose attention was first called to the lung lesion by a hemorrhage; cases in which the respiration is markedly embarrassed in lower levels, do not do well, a fact common to all high altitudes.

The unfavorable conditions existing are those common to all high, dry altitudes, *e.g.*, rapid changes of temperature from day to night and occasional southeast winds.

The rapid changes of temperature are unfavorable only in the lack of ability of the patient to guard against them, and

necessitate only a little extra care regarding clothing and habits, a care which from some unknown reason the average phthisic finds difficult to perform.

The winds occurring chiefly in winter, and having a season of their own, mainly February and March, are directly a benefit rather than a detriment to the consumptive ; while they necessitate his being housed for part of a day, they freshen and invigorate the air—so much so that the exhilarating effects are immediately perceptible. In the sheltered mountain cañons their effects are felt but slightly, if at all, and even in the valley and plain there is an absence of the depressing effects of the moist eastern winds. During their passage across Texas they have parted with their moisture, and make their appearance in New Mexico as a thoroughly dry, cool wind. Records of United States Army posts available to the profession at large, show that they have not produced any increase of respiratory troubles, and that, on the contrary, they have acted as a general tonic.

Such, briefly expressed, are the opinions of the medical fraternity in New Mexico. Physicians who have been in the Territory for years prior to the coming of the railroads, who have seen cases for a greater or longer period and by reason of the limited number of Americans here, have been able to trace them for at least fifteen or twenty years.

The very accessibility of New Mexico at present is a drawback to many cases. Formerly the journey from Kansas City, or Independence, Mo., occupied the greater part of two months, and owing to the high rates charged by the stage line the majority of health-seekers came with traders' caravans. In this way the elevation was gradually attained, the diseased lung had time to accommodate itself to the rarefied air, and the heart was not called upon to answer to sudden strain. At present, in the desire to annihilate time, the patient is raised in twenty-four hours from an elevation of nine hundred feet to one of seven, eight, or nine thousand. Hemorrhages simlar to those experienced by balloonists are liable to occur, and the lungs are suddenly called upon to perform severe and unwonted exertion—an exertion which even the healthy find disagreeable and hence dangerous to an organ already showing signs of disintegration.

I have often advised patients in the East to take at least two weeks in the journey from the Mississippi to the Rocky Mountains, and have found them able to stand the passage of the mountain passes with but slight discomfort and no signs of hæmoptysis, while others, no worse off as far as physical signs could reveal, would experience painful dyspnœa and most likely not escape without a loss of blood. If this rule was more generally followed, it is my opinion that the majority of cases would enter a high altitude better fitted for respiratory action and less liable to manifestations of cardiac trouble.

One fact more occurring in my own cases, and one which I regret that I have not the opinion of the profession at my back: cases of acute phthisis—cases which twelve years since when in the East were sent away with a view to remove climatic influence—are not benefited by residence here.

I have now had an experience of ten cases corresponding to acute miliary phthisis, without hæmorrhage, with cough expectoration and rapid wasting of tissues, and in all these cases while the cough and night sweats would apparently disappear, they have steadily lost ground and finally succumbed. It may be that I am prejudiced and unduly so, but when approached by medical friends East regarding such cases, I invariably tell them to stay where they are or to seek localities within reasonable distance of home.

In my own opinion the cases not to be benefited by the climate are:

1. Cases in which the amount of lung tissue left is insufficient for respiration at lower levels.
2. Emphysema.
3. Bronchial dilatation.
4. Phthisis occurring in the aged or persons too weak to take exercise.

For other cases the extreme dryness of the climate, the predominance of sunshine, and the ability to seek within its borders varying degrees of altitude and surroundings, render New Mexico a desirable climate for phthisical patients, provided, however, that the patient himself is willing to assist.

THE CLIMATE OF OUR HOMES, PUBLIC BUILDINGS, AND RAILROAD COACHES, A LEADING FACTOR IN THE PRODUCTION OF THE ANNUAL CROP OF PULMONARY DISEASES.

By R. Harvey Reed, M.D., Mansfield, Ohio.

While the word climate, in the broad sense of the term, is usually applied to the peculiarities of the seasons of a given latitude, as regards the temperature, moisture, prevailing winds and sunshine, as well as the local influences effected by the cultivation and consequent changes in the soil and its products ; yet, in a more circumscribed sense, it is also just as applicable to the variations in temperature and qualities of the air in our homes, public buildings and railroad coaches, as it is to the more extended area of a country or any particular region of the same. The climate of a country is the legitimate result of certain natural causes, producing consequent effects, which may be modified in a degree by artificial conditions. The climate of our homes, public buildings, and railroad coaches is largely the direct result of artificial causes, followed by their corresponding effects.

When this association was organized at Washington, in 1884, it adopted for its object "the study of climatology and hydrology, and diseases of the respiratory and circulatory organs," and a great deal has been said in its transactions, of the various climates of this and other countries, regarding their good or bad effects on certain diseases. A great variety of opinions have been expressed as to which locality and what particular conditions of climate are most congenial to the restoration of lost health in the greatest number of cases of a given disease. As a rule, a change of climate is seldom sought for the prevention of disease, but more generally for its supposed curative effects, after certain diseases have been contracted.

That the purity of the air, the regularity of the temperature, and the hygrometric conditions of the atmosphere play an important part in the production of a healthful climate and the prevention of certain diseases, stand without a question. That it is better to prevent disease than to cure it, is a self-evident fact.

In order to prevent disease it becomes a necessity that we know at least the chief causes that lead to its production. For brevity and convenience, we will divide all pulmonary diseases into two general classes: First, those of tubercular origin; second, those of non-tubercular origin. Each of these has its predisposing and exciting causes. Among the predisposing causes of pulmonary tuberculosis are: congenital predisposition, or the so-called tubercular diathesis; the reduction of the vitality by syphilitic poison, which may often be as remote as the third and fourth generations; illy ventilated rooms, poor or insufficient nourishment, or prolonged mental depression—any of which leads directly to a general reduction of the vital forces, which soon creates a fertile field, and puts it in a high state of cultivation for the development of a productive crop of active tubercles.

Among the exciting causes of pulmonary tuberculosis are: the introduction into the system of active bacilli from persons suffering from the advanced stages of phthisis; the incomplete oxidation of the blood by the constant inhalation of impure air; extreme and sudden changes of temperature; exposure to draughts of air, and great variations in the moisture of the atmosphere.

In the non-contagious pulmonary affections, the leading predisposing causes are: constitutional weakness, chronic alcoholism, the continual inhalation of air laden with fine dust or obnoxious gases. Age is another cause: the very young and the advanced in years are more apt to contract non-tuberculous pulmonary affections than those in the prime of life. The chief exciting causes of non-tuberculous pulmonary diseases are: sudden and extreme changes of the temperature, the exposure of one part of the body to a very warm and the other to a much cooler temperature, sudden changes from a moist to a very dry atmosphere or the opposite, exposure to draughts of cold air, and the inhalation of impure air.

With these preliminary remarks, we will, first, investigate the climate of our homes, public buildings, and railroad coaches, and try to ascertain in what respect they become leading factors in the production of the annual crop of pulmonary diseases ; and, second, how said causes which lead to the production of pulmonary affections, can be so modified and their climates so improved as to avert to a great extent these disastrous results.

"Our homes" cover a great variety of architecture, all possible shades of comfort, and every imaginable method of heating, from the open fire-place to the most improved air warmers of the age, and from no provision whatever for change of air to complete scientific ventilation. From personal investigations, continued for years in quite a number of our Northern States, I find that but few homes are blessed with perfect methods of heating, combined with complete scientific ventilation. The homes that suffer the most for the want of pure air and proper heating are the tenement-houses and "flats" of our cities ; farm-houses and ordinary city residences rank next, and, lastly, the palatial residences of our capitalists. Time and space will not permit our going into details, and consequently we will confine ourselves to a discussion of the conditions of heating and ventilation found in the average houses of our average citizens, which constitute by far the great majority of "our homes," and, therefore, cover the "rank and file," so to speak, of our population.

Among the farmers of our country and the laborers of our cities, the average living room is the kitchen, which seldom exceeds fourteen by sixteen feet, with an eight foot ceiling, giving a total of 1792 cubic feet of air, or scarcely enough of air to supply one adult for two hours. This room usually has from two to three windows, and one or two outside and inside doors, and, as a rule, is located at the rear of the main building, and is generally the poorest finished room in the entire structure. It is usually heated with a common cook stove, and is used for a cooking department, and dining and sitting-room combined. In short, the entire family live in this room, when in the house, except during the sleeping hours. There is no provision for ventilation except by the doors and windows, which are usually very loosely fitted, and furnish numer-

ous draughts of cold air from nearly all sides of the room, while the cook stove furnishes the main exit for the foul air, or rather the chief source of any circulation of air whatever.

Allowing five members as the average of an ordinary family, and one thousand cubic feet of air for each person per hour, the average amount of fresh air which should be supplied, and they will require five thousand cubic feet of air an hour, and consequently would breathe all the air in the room in less than twenty minutes. A room under these conditions, after making a most liberal allowance, would not receive to exceed five hundred cubic feet of fresh air an hour from the cracks in the windows and doors, or but one tenth of the actual amount necessary, unless a door is opened or a window raised or lowered, which is seldom the case, especially when the temperature is low, and when done is a very objectionable method of ventilating at best—particularly in cold weather. The temperature in a room heated and ventilated like this, will vary from 20° to 40° Fahr. between the floor and the ceiling and the more remote parts of the room I have seen water freeze in one part of a room like this, with a red hot stove in the other part, and the thermometer registering 75° Fahr. on the wall, at the level of the head. Again, I have seen as high as 35° difference in such rooms between the head and feet while sitting on an ordinary chair, and yet people wonder how they "catch cold," and contract pneumonia, pleurisy, and acute bronchitis, or suffer from nasal catarrh and frequent attacks of quinsy. Nor is this all. Go with me to the sleeping-rooms of these same people, and here you will generally find an eight by ten, or ten by twelve room, with an eight foot ceiling, or not to exceed 960 cubic feet of air—a scant supply for one person for a single hour—but these rooms usually contain two inmates, and not infrequently three or four. In the former there would be just pure air enough to supply the two persons half an hour. These rooms are seldom heated, and less seldom the windows are either raised or lowered to admit fresh air, which must find its way in around the crevices of one or two windows and a single door. We will make a liberal estimate, and allow one hundred cubic feet per hour for each window and door when closed, which in the case of two windows, would amount to three hundred cubic feet per

hour—less than one third the requisite amount for one person, and less than one sixth the amount for two ; or an average of one hundred and fifty cubic feet of fresh air per hour to each person, with no provision whatever for the escape of foul air, except by the same channels, the doors and windows. Is it any wonder they get up in the morning with headache, and have frequent attacks of throat and lung diseases? The wonder is there is not more

Let us leave "our homes" for the present, and go to our public buildings, of which the school-house is the most important. It has been my privilege to make personal inspections of hundreds of schoolhouses and scores of churches, court-houses, hospitals, almshouses, jails, several State and provincial capitals, a few penitentiaries and asylums, and one national capital—which, combined, form the basis of my personal information on this part of the subject ; and, with few exceptions, when weighed in the balance with approximately perfect heating and ventilation, they were found wanting.

In the large majority of our public buildings there is a variation of temperature existing in the same room in ordinary cold weather, of from 15° to 35° Fahr. between the floor and the ceiling, and those parts of the room most remote from the heating apparatus ; while the fresh air supply is either inadequate or absent altogether. Generally, there is no provision made for the escape of foul air whatever. Occasionally there is an open grate, or stove with open doors, which allows a portion of the foul air to escape, but usually in these cases there is no provision, outside of the windows and doors, for the supply of fresh air. By the usual methods of steam and hot water heating, there is neither provision for the introduction of fresh air nor the escape of foul air. I have seen scores of school rooms with from forty to sixty scholars in them, and no provision for heating, except a stove, and no provision for fresh air besides an open door, window, or transom ; in which case some scholars must sit in a draught of cold air, others in a part of the room which is too hot, and the rest in a part that is just as much too cold. I have seen scores of schoolrooms heated by furnaces which only supplied from two to six thousand cubic feet of "red-hot" air per hour, for forty-five or fifty scholars, or not more than one hundred and fifty cubic

feet of air an hour for each scholar (instead of at least one thousand or one thousand five hundred cubic feet of warm air for each child for the same length of time), without any provision, except the doors, windows, or transoms, for the escape of foul air. Just imagine from six to ten scholars being restricted to the use of only air enough for one scholar, and while being starved for pure air, and tortured by extremes of temperature, their brains being taxed with long lessons and burdensome tests. Is it any wonder that after twelve or fifteen years of this kind of torture, they finally succumb to pulmonary tuberculosis, and fill a premature grave?

Next to the homes and public schools, there are, perhaps, more people living in passenger coaches than in any other class of structures, take it the year round. Let us see what kind of a climate they furnish the great army of the travelling public. After a series of systematic inspections on four of our trunk line railroads, and the inspection of some thirty passenger coaches of all classes, from the smoking car to the Pullman palace coach, I have found a variation of temperature between the floor and the level of the head while sitting on an ordinary seat, in each car examined, which ranged from 12° to 30° Fahr. in first-class coaches. The coach referred to in the first instance was a ladies' coach, heated with hot air, while the temperature outside the car was only 15° above zero; and in the latter case the car was a Pullman sleeper, heated with hot water, with a coil of pipe under each seat and extending around the sides of the car, with the outside temperature 12° above zero. In the coaches heated with common stoves, hot water, or steam, there are no provisions whatever, except the windows, doors, and transoms, for the admission of fresh air or the exit of foul air (except when the stoves are used a little foul air escapes through the stove), and these sources are not only exceedingly unsatisfactory and incompetent, but positively dangerous to the health and lives of the passengers. In the coaches heated by hot air, the supply of fresh air used is not only irregular, but insufficient, and varies with the direction of the wind and the velocity with which the train is running. None of these coaches are supplied with foul-air exhausts, outside of the draught in the stoves, the doors, windows, and transoms.

The average number of passengers found in the thirty coaches inspected, was twenty to a coach, varying from seven to fifty-seven ; this would require an average of at least twenty thousand cubic feet of warmed air to the car every hour, and proportionate exhaustion of foul air to keep the atmosphere of the car in a practicallly pure condition. We also found from 4.41 parts of CO^2 in ten thousand parts of air, in the summer time, with the doors and windows open, and only eleven passengers in the car, to as high as 18.33 parts in the winter season, with fifty-seven passengers in the coach.

By these series of researches we have found that from the cradle in our homes to the public schools, from the schools to the churches and public buildings, and from the quiet cottage or busy counting-room of every-day life, to the whirling palace car, we are bathed in one continuous impure atmosphere. From the moment they are born until the shroud is drawn around them for their last sleep, the great army of people who live indoors are breathing impure air. They send their children to school, where they breathe and rebreathe the air over and over again. Nay, more, the putrid breath of the syphilitic and tuberculous child is inhaled by the child with rosy cheeks and a sound constitution, from the beginning to the end of the school year. You would scorn the idea of having but one handkerchief, tooth-brush, or tooth-pick for each school-room, and having your children all compelled to use them daily in common with the rest of the scholars, but you sit with folded hands and peaceful conscience while your children violate sanitary laws a thousand times worse, by the inhalation of millions of cubic feet of foul and even putrid air from their diseased classmates, each school year.

Again, the fond mother sits her helpless child on the floor and tries to have it amuse itself with toys, while its whole body is bathed in an atmosphere from 15° to 20° colder than the body of the mother, and then wonders why it cries and is discontented and fretful, and is in a perfect quandary as to how it ever contracted pneumonia. If it survives this it is sent to school and not only bathed in a poisonous atmosphere, but subjected to draughts of cold air from windows and transoms in one part of the room, or overheated in another,

while, as a rule, its feet are bathed in a stratum of cold air from morning until night.

How many of us who in our younger days played the *role* of school-teacher, cannot recall the frequent and familiar plea of "Please, may I go to the stove to warm my feet?" and recall the sickening cough, cough, cough, of the child with "only a cold," or picture the flannel-bound necks of the children with sore throats, and point in our mind's eye to the flushed cheeks and watery eyes of the child with the "splitting headache," vainly striving to get out a lesson for the coming recitation; and yet, with all these melancholy facts staring us in the face, like ghosts from the graves of the martyrs, from bad heating and ventilation, we have gone on and on for years with little or no improvement for the relief of these conditions which cause the death and daily suffering of countless thousands of our rising generations.

Is it any wonder their constitutions are undermined and their health broken down at the age of twenty, and that before twenty-five a large percentage of them fill the consumptive's grave? Is it any wonder that countless thousands of children die of acute lung trouble before they reach the age of five years? Is it any surprise that pneumonia so frequently claims the business man as he turns the age of forty, and hustles him off to meet his God, with scarcely a moment's warning?

Oh! no, my fellow-practitioners, these are only the legitimate results of physical causes and of the direct violation of sanitary laws; and just so long as we continue to heat and neglect to ventilate our homes, our public buildings, and railway coaches as we do at the present time, just so long may we expect to find the annual crop of pulmonary diseases to stand at the head of the mortality list in all our annual health reports. Just so long as cause is followed by effect, and just so long as the great masses of our people are exposed to one continuous bath of impure air, complicated with great extremes of temperature, just so long may we expect consumption to stand at the head of the annual mortality list, and the remainder of our pulmonary diseases, generally, to hold their present rank in mortuary statistics. Iron, cod-liver oil, and foreign climates must yield to common sense and sanitary

reforms in our homes, our public buildings, and railway coaches, first, ere we can hope or legitimately expect to see any reform in the mortuary statistics of pulmonary diseases. We have tried in vain for centuries to "cure" consumption. People by the thousand and hundreds of thousands have flocked from one health resort to another, vainly seeking to free themselves from the lion grip of pulmonary consumption; they have, figuratively speaking, soaked themselves in cod-liver oil, and clad themselves inside and out, with iron; they have loaded their poor stomachs with the hypophosphites, and been pumped with the pneumatic cabinet, and injected with carbonic acid gas; but the end was all the same—it was only a question of time until the funeral knell sounded the requiem of their departed spirits.

These are undeniable facts, and as such should claim not only our attention as physicians and surgeons, but our united efforts in search of relief. The law compels our railroads to guard city crossings, and in many States to stop all trains at junctions, besides a dozen and one other things for the physical protection of passengers. School boards quarrel over the kind of text-books, the style of seat, or particular form of architecture they shall adopt, while our fellow-countrymen waste their physical and mental energy to have a pretty home painted and papered in the latest style. But scarcely one of them spends a moment of time or a dollar of money to secure perfect heating and ventilation, which are a thousand times more important to their physical prosperity and length of days.

The question naturally arises, how shall we heat and ventilate our homes, public buildings, and railroad coaches, with practical perfection? In answer to this question I will say: there are three prime factors that must be carefully considered. They are: 1st. A practically uniform temperature should be obtained through each room or car; 2d. From one thousand to one thousand five hundred cubic feet of pure air, warmed to about 70° or 75° Fahr., should be supplied each occupant hourly; 3d. The prompt removal of all foul air from each room or car as fast as it is produced. While securing these prime factors, it is also necessary to observe four other important features in the selection of the apparatus and

system for heating and ventilation. They are: 1st. Safety; 2d. Economy; 3d. Durability; 4th. Simplicity. To accomplish the required results in compliance with the above requisites, an air warmer should be used with sufficient radiating surface to simply warm the required amount of air to the required temperature without the air having to pass at any time over a red-hot surface of iron, or be heated so hot as to materially deprive it of its natural amount of moisture. This may be done by three principal methods: 1st. By passing it over pipes heated with steam; 2d. By passing it over pipes warmed by hot water; 3d. By passing it over the heated plates or through the air flues of a furnace or stove. The first and second methods are what is known as indirect heating and ventilation, and when properly constructed and in good order, give fairly satisfactory results. The objections to these methods of heating air are: 1st. It is much more costly to secure the necessary plant, and from one fourth to one third more expensive to run than the direct system of heating; 2d. In climates where the temperature falls under 12° to 15° below zero, the indirect system is a practical failure, as the condensation in the steam pipes is greater than the expansion, while the water pipes cannot be kept sufficiently warm; 3d. The danger of explosions, even with low pressure, in the hot-water system, makes these methods more or less objectionable; 4th. The expense of repairs and the replumbing of a part or the whole of the heating apparatus every few years. The third method is what is known as the warm air or direct method of heating and ventilating, and is not only the least expensive to commence with and by far the most desirable, but decidedly the safest and most efficient method of heating and ventilating yet discovered.

A furnace should be so constructed as to have a large heating surface, without escape of dust or gas from the fire, and at the same time economize the fuel by utilizing all the heat possible, by transmitting it directly to the air to be warmed. In no instance should the air pass over red-hot iron, or only a portion of the air be heated very hot and allowed to cool off by mingling with the cold air of a room; but the entire quantity of air required for a building or any part of it, should be heated only sufficiently to maintain a temperature of about

70° or 75° Fahr., when it is distributed through a room, and at the same time retain its natural moisture. Whenever a furnace or stove requires an evaporating pan to keep the air moist, it is high time such a stove or furnace should be removed, and a modern furnace or stove become its successor. After the air has been properly warmed, the next important question is, Where shall the fresh warm air enter the room and where shall the foul air be allowed to escape? Time and space will not permit me to enter into the details of this part of the subject, and give you all the reasons for the faith within me. Suffice it to say that the method which gives the best results, everything considered, is the one which brings the warm air in at the floor, at the side of the room least exposed to the external elements, and exhausts the foul air at or near the windows, or, in other words, at the side of the room most exposed to the weather, and afterward returning it in tight conduits under the floor, delivers it to the ventilating shaft. By this method the cold foul air is immediately exhausted through the ventilating shaft, which keeps the air in the rooms pure and of an even temperature. I have repeatedly examined rooms heated and ventilated by this method, and have failed to find more than from 3° to 5° Fahr. between the floor and the ceiling, or the warmest and coolest parts of the room. My own house is heated and ventilated after this method, and is open for inspection by any person who is interested in the assertions I have just made.

The old method of putting a register at the top of the room, for the escape of the foul air, is neither economical nor scientific, as it wastes your heat, cools off your room, and leaves the cold foul air as its legacy. It may be said for people in moderate circumstances, that this is too expensive. In that case, I would recommend them to get improved heating stoves, made to carry out this general plan, and which are provided with an air chamber that is supplied with fresh air from the outside of the room or building, which in turn is warmed and delivered to the room to be heated and ventilated; while the foul cold air can easily be exhausted through a double chimney with an opening at the floor, on the one side, for its escape; all of which can be done for less than would pay the doctor bills for one case of pneumonia.

It has cost thousands and tens of thousands of dollars to practically demonstrate the few condensed facts I have just given you in this paper, besides years of experimenting and repeated investigations to detect and eliminate the defects, and develop and establish the correct principles of heating and ventilation, and put them on a practical basis ; and to that ingenious, persevering, energetic, and progressive sanitary engineer, Mr. Isaac D. Smead, of Toledo, Ohio, this country and the world at large owes more than to any other living man, for the practical development of the most economical and scientific method of heating and ventilating our homes and public buildings, which has yet been developed.

But, you very properly ask me, how are you going to improve the heating and ventilation of our railway coaches, which may be called portable houses and must be supplied with portable heating apparatus and be duly provided against currents and countercurrents of air produced by the running of the trains? I will answer you that the same general principle of introducing the warm air at the floor and exhausting the foul air at the same level, will hold good in the railroad coaches just the same as in a private room or a public building. In order to accomplish this the windows and transoms must be kept closed, and the fresh air of each car supplied by an air pump from the engine, which air supply, when necessary, should be warmed by being passed over the radiating surface of steam or hot-water pipes, or some form of safe, portable furnace, before entering the car. By this method a regular supply of fresh warm air could be supplied to each car, regardless of the outside zephyrs or the direction or speed the car was running, while the same gentle but regular air pressure would constantly facilitate the escape of the cold foul air and keep the floor of the car comfortably warm and the air of the coach practically pure, day and night.

That these methods of heating and ventilating our homes, public buildings, and railroad coaches are a practical success, especially in the first two instances, is now beyond a peradventure, and that they will remove the foul air from a room has been proven by repeated chemical analyses ; while the hydrometer has shown that the natural moisture of the air is practically retained, and the thermometer has determined the

regularity of the temperature thus obtained, which shows but a trifling variation in any part of a room.

Who can assert that an abundance of pure air of a regular temperature and moisture, is not preventive of pulmonary diseases? That is just what we seek to find in our health resorts for the relief of pulmonary affections—a regular climate which is neither too dry nor too moist, and never too cold or too hot, and which is supplied with oceans of pure air the year round. Are not these the conditions of climate we have just shown you can be produced in every home, public building and railroad coach throughout our land, if properly heated and ventilated? Then can an Italy, a Florida, a California, or even a Colorado, boast of more? But even granting they can furnish an invalid all of these conditions of climate in their perfection, only a limited few of the surging masses of humanity can afford these natural blessings, while the preventives I have just prescribed are within the reach of all, whether rich or poor, high or low, from childhood to old age.

We dare not deny that the production of a regular climate of pure air, such as we have suggested, although the production of art will aid materially in reducing the annual crop of pulmonary affections; neither can we deny that the opposite conditions, which we have shown you now exist, aid very materially in increasing the annual crop of pulmonary diseases, throughout our land.

Our laws throw their protecting arms around the swine in our pig pens and the cattle upon a thousand hills, and say to the contagious diseases that affect them, "Thus far shalt thou go, and here shalt thy destroying arm be stayed." Are not the health and lives of our fellow-citizens—nay, I will put it, your daughter or my son, worth even as much as those of the dumb brutes in the field? And yet, the laws of our land are practically as silent as the Statue of Liberty in New York Bay, on the question of a bountiful supply of God's pure air in our homes, public buildings or railroad coaches.

Our Prohibition friends have organized and maintain a third political party, and spend millions of dollars annually to prevent the suffering and premature death of the inebriate, which only constitutes a fraction of the premature deaths produced by the ravages of pulmonary affections throughout the length

and breadth of our land, each year. I doubt if they have ever turned a hand or spent a dollar to secure a reform in heating and ventilation, and thereby aided in preventing a far worse and much more fatal affection of the human family than even chronic alcoholism, and at the same time one that to a large extent can be prevented by compelling and maintaining, if need be by law, a generous supply of God's pure air to every home, public building, factory, workshop, store, office, and railroad coach throughout our land.

When this is accomplished, and not until then, can we ever expect to see the dawn of a sanitary millennium, in the reduction of the mortality statistics of pulmonary affections to a common level with ordinary diseases.

THE DETRIMENTAL EFFECTS OF OVER-EXERTION IN PULMONARY PHTHISIS.

By Karl von Ruck, M.D., Asheville, N. C.

Inasmuch as no material benefit can be expected from direct medication in the treatment of pulmonary phthisis, and inasmuch as success must almost entirely depend upon management, which may be called a hygienic and prophylactic therapeutics, I have in pursuance of the latter endeavored to study as closely as possible, to what extent it is really practical to influence the course of the disease.

In so doing, I have had the advantage of being able to give my entire attention to the treatment of phthisis for some years past, during which a large number of cases have come under my care, both in private practice and in my special institution.

By the close association with patients, it has been possible to observe the conditions under which they appeared to improve and recover, and also the apparent causes which led to reverses and relapses, some of which I had formerly failed to appreciate to their full extent.

It is now my purpose to point out in this communication one of the causes which I have found to exert the greatest influence upon the course of the disease, not only as an obstacle to favorable progress, but frequently leading to reverses not again recovered from.

I refer to physical and mental over-exertions and the thereby induced heart-fatigue.

Having found my patients so uniformly inclined to carry these beyond the limits of benefit and safety, and having seen more or less serious results to follow such indiscretions most constantly, I am fully convinced that if this cause alone could

be eliminated, the cases of improvement and recovery would be increased in number more than an hundred per cent, and I ascribe the better results obtained in my institution, as compared with those in private practice, in no small measure to the control in this matter, which I there am able to exercise.

The cause for these constant indiscretions on the part of phthisical patients is apparent, and depends upon the fact that the more intelligent understand very well how little they really have to hope from the administration of drugs for the cure of their disease, and that they place their only hope in the out-of-door life and exercise, which has been recommended most urgently by their trusted medical advisers, and so anxiously do they cling to this supposed only chance, that any attempted limitation of it is looked upon by them as a doubtful measure and with apprehension.

Certainly, so long as they are able to follow a contrary course they are most unwilling to dispense, even only in part, with what is to restore to them their health.

They can see no harm in taking in, as much as possible, of the air which will heal their lungs, by forced respiration carried on purposely or produced by violent exercise, and the latter they feel sure will restore their former strength. This belief on the part of patients is, however, largely due to medical advice, in which out-of-door life is, as a rule, conjoined with exercise, without proper caution as to the latter. Indeed, I know of eminent physicians having advised as much as possible of both for patients who should at the time have kept their beds.

It is truly pitiful to see such patients literally drag themselves about, exhausting what little strength and recuperative power they may still possess ; and more so yet, to see how, under the mistaken association of exercise with the necessary out-of-door life, their wasting becomes more evident from day to day, their steps less secure, their frames more stooping, their stopping "to catch breath" more frequent, and the hectic flush more distinct upon their sunken cheeks, until finally, from utter exhaustion or from resulting relapses and complications, they are obliged to keep to their houses and rooms. But even here they resort to indoor gymnastics—swinging dumb-bells or Indian clubs, or box against an

imaginary foe in the form of a suspended and inflated rubber air-bag, or other contrivance calculated to offer resistance to their self-exhausting blows. Such sights are not uncommon in advanced cases, and the picture is only less painful in cases of the early stage because there is still a relative appearance of well-being, but so long as they tax their strength to the utmost in violent exertion, the advanced stage is reached surely and steadily, although the pace may appear less rapid.

To illustrate the injurious consequences of over-exertion, I append notes from my case books of a limited number, some from my institution and others from private practice.

Case 1. Gentleman in early stage of pulmonary tuberculosis: had been free from fever for over five weeks, during which the pulse rate had not been recorded above eighty-eight, he had gained eleven pounds in flesh, and his general condition, as well as the local state of his lungs, were highly satisfactory. He had thus arrived at a period where, by reason of consciousness of returning health, the tendency to over-exertion is particularly manifest. Contrary to his general directions, he exceeded the amount of exercise allowed him, by a walk of over six miles, returning much fatigued. He had no appetite for his next meal, and the record for the evening shows, temperature one hundred, pulse one hundred and twenty, respirations twenty-eight. It was a week before his previous condition was restored, with the loss of five pounds in weight, which it took him a month to regain.

Case 2. A young lady in more advanced stage of pulmonary tuberculosis: active symptoms had been absent for four months, during which there was no fever, pulse rate eighty to ninety-six, respirations twenty-two to twenty-four, appetite good, slight cough, and scant expectoration early in the morning, few bacilli were still present in sputum. Her body weight had reached one hundred and thirty pounds, which was more than she had ever weighed. At this time she ascended a neighboring mountain, and returned hurriedly on account of some fright. She arrived completely tired out, panting for breath, and with a pulse which could hardly be counted—about one hundred and forty. Within an hour she expectorated several mouthfuls of clear blood, the pulse continued between one hundred and twelve and one hundred and

twenty for several weeks, on the third day febrile symptoms with loss of appetite appeared, during the month she lost eleven pounds of flesh, and did not regain her previous condition until three months thereafter.

Case 3. Married lady; pulmonary tuberculosis: had just passed through stage of softening in right upper lobe, but was now improving in all her symptoms, being, however, still forbidden all active exercise, for which massage was substituted. Believing herself strong enough, and desirous of a change, she walked down-stairs and upon the piazza and returned to her room within half an hour, when her temperature had risen two and a half degrees Fahrenheit and her pulse rate increased thirty beats per minute, above any record for three weeks previous. She had no appetite for several days, lost two pounds of flesh that week, whereas the week previous she had shown a gain of three pounds.

Case 4. Same patient: about two months later she had made much further improvement, fever was now practically absent, pulse one hundred, respirations eighteen, had been allowed short carriage rides with apparent benefit. Limited to half an hour, on the present occasion she was out two and one half hours, and also stopped in town for some shopping. She returned so tired that she had to be carried to her room, chill occurred twenty minutes later, high fever and loss of appetite set in, she relapsed in every way and never again reached the improvement at which she had arrived before this last ride.

Case 5. Gentleman in advanced stage of pulmonary tuberculosis: a large, suppurating cavity in right upper lobe, history of repeated hemorrhages and a severe one, just recovered from before his arrival. He resided a short time in my institution, during which he gained in flesh, fever and pulse rate had become less with almost every day, and his appetite improved correspondingly. Desirous of getting cheaper accommodations, he went to a boarding-house about one mile distant, and returned thereafter several times for advice, always on foot, and each time his pulse rate was very rapid. In ten days he lost all he had gained, and he again returned to my house. Improvement occurred once more, so much that he believed himself much stronger in every way, and per-

sisted in ascending the mountain in the rear, claiming that he enjoyed it and that it did not hurt him in the least. Upon every occasion, however, I found that his pulse rate increased from thirty to forty beats and continued so for a number of hours later. I was fearful of return of hemorrhage, which I held up to him as a likely occurrence, begging him to desist; but although he promised, he took another trip without my knowledge. Returning, he died of a violent hemorrhage a few minutes after he had reached my house, and although at his side almost instantly, there was no time to render him any material aid.

Case 6. Gentleman with tubercular phthisis: entire right lung involved and circumscribed breaking down in upper lobe; he made a moderate sized cavity in the course of a month, during which he had kept his room most of the time. Although he had much fever and little appetite, he maintained his weight through this period. Improving thereafter rapidly, he was kept out-of-doors almost continuously, but his exercise was limited to repeated short walks upon the level grounds and to short carriage rides. He, however, soon began to extend his walks to distances of a mile or two, which were followed each time by a slight return of fever and increase in cough and expectoration, and as soon as he had recovered from one reverse he was sure to produce another by his indomitable desire to take long walks, and no amount of remonstrance seemed to bring him to his senses, until I informed him that unless he desisted our relation as physician and patient would cease.

At this time he had lost thirteen pounds of flesh, had regular evening fever, with continuously rapid pulse and profuse expectoration.

Henceforth we had no further trouble, and as by returning improvement he recognized his previous folly, he became not only a most exemplary patient, but grew actually timid, so that I had frequently occasion to urge him to increase physical exertion.

Case 7. Young lady in beginning of advanced stage of pulmonary tuberculosis: with a tendency to get into trouble, if there was an opportunity ever so remote, had had many slight relapses from mental and physical over-exertion, but after

many trials permanent arrestment after a year's residence in my institution was finally obtained.

Her general health was good and local symptoms were absent, but her endurance seemed still to have a limit. As she was about to be discharged I gave my consent to horseback exercise, for which she had long besought me; this time rather to make a test, as she was sure to take it up upon her return home. No harm resulted until she exceeded the limit of one hour and stayed out all the forenoon in company with another patient. From what I could learn the ride was rather a wild chase than one for health; it resulted in immediate loss of appetite sense of fatigue and malaise, increased pulse rate for several days, during which she lost several pounds of flesh, menstruation occurred a week in advance, and altogether it delayed her discharge for nearly a month.

Case 8. Young lady in early stage of pulmonary tuberculosis: she accompanied the patient whose imprudence I have just related.

Being an inexperienced rider, she was limited to half an hour, and several such short rides taken previously had appeared beneficial. At this time she was gaining in every respect. She did not come off as easily as her companion. On her return she seemed utterly exhausted, active symptoms returned, which confined her to her room for several weeks, physical examination showed extension of the disease; she lost six pounds of flesh, but made up her relapse during the month following, when she returned home for the summer.

Case 9. Gentleman with pulmonary tuberculosis past the early stage: had resided in my institution several weeks and had followed advice conscientiously with so much benefit, that he was evidently improving. One morning he retired to his room after breakfast and engaged in letter-writing until noon, by which time he reached a temperature of 102 and a pulse rate of 130; he had no appetite for his dinner and for several meals thereafter, and it took him a week before he felt well as before, during which time he lost two pounds in flesh.

During the week before he relapsed his temperature had only once reached 100, his highest pulse rate 96, his appetite had been good, and his weight had increased three pounds.

He told me on another occasion that he had not believed the letter-writing to have been the cause of his relapse, and therefore tried it once more with almost identical results, and I found, in his case, that even a game of cards or prolonged animated conversation had a similar although more transient effect.

Case 10. (From private practice.) Lady with non-tubercular phthisis in somewhat advanced stage. She believed in plenty of out-of-door life and exercise, and her home physician had so ordered. Under regular horseback exercise on every fine day (and we have on an average of about twenty-five in each month) or long walks instead, she had lost twenty-two pounds in weight in the three months she had been in Asheville. Her temperature at the time she consulted me reached one hundred and three and over, her pulse was one hundred and thirty, cough, expectoration, and night sweats kept her restless at night, and she was very much discouraged. By my advice she restricted her physical exercise to short walks and carriage rides, and beyond some treatment for nasal stenosis and pharyngeal catarrh, and the regulation of diet, no other change was made in the management of her case. After a month she had gained eight pounds, her temperature and pulse rate were much less, and she expressed herself as feeling better in every way. Three months later she returned home greatly improved, having made a gain of twenty-seven pounds in flesh from the time she came under my care, active symptoms had disappeared in the affected lung, and there was an almost entire subsidence of fever, cough, and expectoration.

Case 11. (From private practice.) Lady with tubercular infiltration of right upper lobe and moderate deposit in left ary-epiglottic fold. She consulted me on account of growing constantly weaker and having much fever, and desired to know of a more suitable climate for her case. I found she lived in a boarding-house a mile out of the city, and to get proper exercise and to keep up her strength, she walked that distance once and often twice a day. I pointed out her error, and persuaded her to place herself under more favorable conditions. She entered my institution soon thereafter, where her larynx received some attention and her exercise and diet

were properly regulated. Before she left Asheville, two months later, she had made remarkable improvement, which had begun immediately upon her admission. She could now walk several miles without injury, had gained her former weight, was free from fever, and, as she expressed it, "felt well enough to go home." Bacilli had been absent in the slight expectoration at the last two examinations made.

Case 12. (From private practice.) Gentleman with pulmonary tuberculosis: entire right lung involved and slight excavation in upper lobe. Called upon me on account of continuous loss of flesh and strength, fever, and almost daily bloody expectoration.

He had lost fourteen pounds in the six weeks since he had left home, had high temperatures and rapid pulse, frequently vomited his food on account of severe cough, and was very much exhausted. His physician had advised him to go to Asheville, let doctors alone, get a horse and ride through the country, if he wanted to save his life!!! He had followed this advice, and was unwilling to give it up, and although he now restricted his exercise somewhat, he was worse after a month, during which he consulted me several times. He had lost six more pounds of flesh, and an acute pleurisy now intervening, laid him up and stopped his folly! After partial recovery he confessed himself ready and willing to do whatever I thought best for him, and he kept his word. Neither had we any further trouble; he improved rapidly and returned home with his cavity cicatrized, all rales had disappeared, he had gained nine pounds in flesh, fever, cough, and expectoration were improved, he was able to walk a mile or two without fatigue or injury, and this without ever again having mounted a horse.

I could now go on and relate many such cases, more or less striking, and all showing the same relation of over-exertion to unfavorable progress. In my practice, I am now most unwilling to abandon inquiry for this indiscretion, when relapses occur that are not otherwise referable. Any physician who cares to can make similar observations for himself, to do which, however, requires the careful keeping of records of frequent observations of temperature, pulse rate, respiration, cough, and expectoration, conditions of the digestive organs,

body weight, etc., and also of the local findings of frequently repeated physical examinations, but which, unfortunately, in private practice seem seldom possible, on account of the amount of professional attendance required which few practitioners are able to give and fewer patients would be able to appreciate.

I have frequently been asked why it is that over-exertion is so particularly harmful in the chronic affections of the respiratory organs, not only by patients, but also by professional friends and physicians, who were my patients, some of them maintaining that sufferers from other chronic diseases are not liable to reverses from similar causes. Less close observers, or those who had perhaps given the matter little attention, have even claimed this for phthisical patients, and indeed the relation is not always so strikingly apparent as to invariably attract our attention, especially in private practice, where we see our patients infrequently, and, as a rule, are only called or consulted after the relapse and when our inquiry (if we make it) elicits only the patients' views in the matter.

Frequently, too, we concern ourselves most with the present condition and its relief; especially in a busy practice we are apt to pay less attention to inquiries into preventable causes than we really should. At any rate, I freely confess that before I was interested in this work as I now am, I allowed myself to be satisfied with the explanation that a patient had taken cold, or with the supposed natural downward tendency of the disease, and it seems strange to me now that the great importance of this matter escaped my attention for so many years of my earlier practice. I know now that relapses from taking cold occur infrequently, and the supposed downward tendency does in fact exist in a diminutive fraction of cases only, in which the disease runs an unusually acute course, but that, on the contrary, there is a strong tendency to repair, improvement and recovery in the great majority of cases, even in such as are well advanced in the disease.

If phthisical patients are, however, more liable to reverses from over-exertion than others (and closer observation may show such liability to exist in sufferers from other affections also, and it is known to exist in certain diseases of the circulatory organs), the accounting seems not so difficult, for we

find a good explanation in the effect upon the right side of the heart, and the lesser circulation of any exercise which increases the heart action and causes a greater demand for aerated blood by the tissues through the systemic circulation.

In the presence of obstruction to a free blood current through the lungs, by reason of impaired expansion, inflammatory and tubercular deposits, connective-tissue proliferation, cicatrization and retraction, accumulated secretions and other causes for pressure upon the pulmonary vessels, the right heart and large venous channels become thereby overloaded, which leads to exhaustion, more or less permanent, of the heart muscle, and to subsequent degenerative processes in its muscular fibres ; even sudden dilatation of the heart is liable to occur from over-exertions, and I have witnessed such a case in a phthisical patient which proved rapidly fatal.

The non-resistance of lung tissue to tubercular invasion and extension, if not produced, is certainly favored by nutritive disturbances due to anæmia and a frequently associated small and weak heart, and either is apt to be preceded as a primary cause or attended as a result by dyspepsia and other gastric complications. Thus a good circulation goes with good digestion and *vice versâ.*

We all know how much more favorable the prognosis may be in a given case, when, other things being equal, we have a good heart with good digestion, as compared with one in which all our efforts to secure these advantages prove ineffectual, and we also know how we would avoid any medication or treatment which influences one or the other for the worse, as scrupulously as we would maintain it if it kept the heart and digestive functions at their best.

All my cases show that the heart action is seriously affected, sometimes for weeks, by such over-exertion, and that with it the appetite is lost and loss in weight occurs most regularly, and it is therefore not to be wondered that with frequent repetition of over-exertions, the downward course, formerly attributed to the natural tendency of the disease, is by rights referable to mistaken self-management or want of control by the professional attendant in the many cases, who make unnecessary shipwreck in their journey for health, both at home and at climatic resorts.

Furthermore, if Metchinkoff's and Buchner's observations continue to stand uncontradicted, and the leucocytes and the blood serum are primarily instrumental in the destruction and removal from the organism of the infecting bacilli, thereby limiting and preventing their extension to healthy tissues, we can see that in tubercular disease any hindrance to the circulation must of necessity diminish the quantity of blood, the number of these so-called phagocytes able to reach the affected part, or the line of defence which for the time being becomes less effectually guarded allowing of greater proliferation, activity and extension of the germs.

But let the explanation be whatever it may, clinically I have experience which, to me, admits of no more doubt that heart fatigue is seriously detrimental to phthisical patients, than I have of the known action of opium or chloroform, or of the relation of the bacilli of Koch to tubercular disease, and I only wish that I knew what more I could say or do, or that I might have sufficient eloquence and power to convince, so as to impress upon the mind and conscience of every physician who advises and treats phthisical patients the great importance of its prevention ; and I am equally convinced that, if I so succeeded, I should have contributed more toward the successful treatment of consumption than has been done by any advance made in this field of therapeutics for many a year past.

Error in the opposite direction is, however, possible, although not fraught with a corresponding amount of danger, and I certainly do not wish to be understood as underestimating the benefits of the rational employment of exercise in the management of phthisis, especially in conjunction with out-of-door life ; I only warn against its abuse.

Nothing could be further from my mind than to recommend absolute rest and inactivity, unless during the existence of fever, acute processes, and certain complications. I believe exercise, short of amounting to fatigue, is highly beneficial to the best circulation, nutrition of tissues, and elimination of waste products, and the want of such to be justly looked upon as a predisposing factor in the acquirement of the disease.

Whenever I am obliged to dispense with exercise I substitute massage, the use of the faradic current, or both, with

much benefit. The mental faculties, too, require proper exercise by light instructive study and literature, innocent and unabsorbing social games, pleasant conversation, enjoyment of natural scenery, music, etc., which are indispensable to the proper diversion of the patient's mind.

The amount of physical and mental exercise must, however, be carefully regulated for each patient, and must remain within the limits of safety at all times. The advice must not be given in a general way, but according to the circumstances of the case, the day, or even the hour. What one patient may do with benefit may prove harmful to another, and what is a proper amount of exercise at one time may lead to disaster under conditions of fever, the presence of complications, etc. It is always best to begin with the minimum and to gradually test the patient's reaction by observations of pulse, temperature, and appetite, loss or gain in flesh, etc., and the physician in an institution must have tact enough to do that for himself at opportune times. The patient is hardly ever to be burdened with the responsibility, and in private practice it requires the competent supervision of a nurse or attendant, without which we had, as a rule, better forego some of the information, for most patients become nervous and timid from such exact knowledge, and I can imagine no more miserable state of feelings and apprehension than that which the consumptive patient, especially if a physician, works himself up to, who at all times and opportunities has his fever thermometer under his tongue and his finger upon his radial artery, and I have frequently been obliged to demand the surrender of the former and the cessation of pulse-counting, to make any progress at all.

Mr. President, I know that many members of this Association share my views, and I make this communication not so much for instruction of the members, but rather that, by their approval, the profession at large may thereby be made the more ready and willing to take cognizance of a preventable and serious obstacles to the more successful management of a disease, the limitation of which is the chief object of the labors of this Association.

TUBERCULOSIS IN THE CRIMINAL CLASS.

By William Duffield Robinson, M.D., Philadelphia.

Perhaps little excuse can be offered to this Association for presenting a sketch titled as above, unless it be to call its attention to a distinct class of humanity possessed of well-defined characteristics—a class interesting in the history of its antecedents and in the habits of life of its respective component individuals. Criminals of every grade are found intermingled among all classes of society and in all places, but the general practitioner has little opportunity to study a sufficient number of cases for obtaining reliable information in regard to them, until such cases have been caught and caged. Even then, indeed, they are usually only accessible for proper study by the medical man who has charge of their health in the various institutions for their detention after conviction. One experienced in dealing with the crime-class people can usually recognize a criminal, but it is indeed difficult to so explain the distinguishing characteristics that another may be able to know the criminal face with reasonable certainty. Many points of peculiarity as to head, form, pupiltary distance, etc., have been made as pertaining especially to criminals. But among a large number of convicts there are found many well-proven chronic criminals who have characteristics of physiognomy, etc., quite directly opposite to asserted laws.

In the Eastern State Penitentiary of Pennsylvania, an institution of which the average population is about eleven hundred, the study of the death causes during the past sixty years shows that more than fifty per cent have been due to tubercular diseases. In this institution there have been received about five hundred and fifty new convicts during each of the past ten years. Of these, about eighteen per cent could give no history of their parentage or family health records. Many more could but imperfectly do so. Among those who knew of their family deaths it is well demonstrated that tubercular disease has been remarkably prevalent. Hereto is appended

the histories secured from among four hundred and eighty convicts received during one year, which gives a fair average demonstration of that of each year. They are, of course, histories of convicts consecutively taken, and not from selected ones.

Convict Number.	Age.	No. of Convictions.	
A 1487	31	4	Father, mother, brother and sister died of consumption; convict has consumption.
A 1488	19	1	Father, mother, brother and sister died of consumption; convict has consumption.
A 1489	20	1	Father died of consumption.
A 1496	28	4	Convict has consumption.
A 1499	51	1	Convict has consumption.
A 1505	32	1	Mother died of consumption.
A 1506	20	3	Mother and brother died of consumption.
A 1509	32	1	Father, mother and brother died of consumption; convict has consumption.
A 1513	23	1	Father and uncle died of consumption.
A 1518	27	1	Convict has consumption.
A 1520	22	1	Convict has consumption.
A 1533	20	2	Father and mother died of consumption.
A 1547	31	3	Mother died of consumption.
A 1549	22	1	Father died of consumption.
A 1550	35	1	Father and mother died of consumption.
A 1556	20	1	Mother died of consumption.
A 1557	21	1	Father and mother died of consumption; convict has consumption.
A 1558	32	5	Father and brother died of consumption.
A 1564	23	1	Mother and brother died of consumption; convict has consumption.
A 1566	34	1	Mother and brother died of consumption; convict has consumption.
A 1568	24	3	Father, mother and sister died of consumption.
A 1570	21	1	Father, mother and brother died of consumption.
A 1574	25	2	Father and mother died of consumption.
A 1577	23	1	Convict epileptic.
A 1575	23	1	Sister epileptic.
A 1582	19	1	Father died of consumption, mother of cancer, three brothers epileptic.
A 1585	38	2	Father insane.
A 1589	39	1	Father, two brothers and one sister died of consumption.
A 1593	17	2	Mother and sister died of consumption.
A 1596	18	2	Sister died of consumption.
A 1597	25	6	Father and mother intemperate; convict epileptic.
A 1599	29	3	Father, three brothers and two sisters died of consumption.
A 1601	18	1	Father died of consumption, sister died of epilepsy.
A 1605	31	1	Father, mother, three brothers and two sisters died of consumption.
A 1607	21	1	Convict insane.
A 1611	60	5	Mother and three brothers died of consumption, father and one brother of epilepsy.
A 1612	25	3	Mother and aunt died of consumption.
A 1613	39	2	Mother and brother died of consumption.
A 1618	16	2	Father died of consumption.
A 1620	18	1	Father, mother and uncle died of consumption.
A 1621	20	1	Father and mother died of consumption.
A 1623	31	6	Three brothers died of consumption; convict has consumption and cancer of womb.
A 1631	32	2	Father, mother, six brothers and two sisters died of consumption; convict has consumption.
A 1634	36	1	Mother died of consumption.
A 1635	26	3	Brother died of consumption.

Convict Number.	Age.	No. of Convictions.	
A 1637	25	1	Mother died of consumption.
A 1642	19	2	Mother died of consumption.
A 1652	31	2	Father and mother died of consumption.
A 1654	27	1	Convict has consumption.
A 1655	22	1	Father died of insanity.
A 1656	23	3	Mother and two sisters died of consumption.
A 1657	38	2	Sister died of consumption.
A 1661	31	5	Mother died of cancer.
A 1663	36	3	Mother died of consumption, brother of epilepsy.
A 1664	56	3	Father died of consumption.
A 1668	38	1	Mother and sister died of consumption.
A 1675	29	1	Mother died of consumption.
A 1676	21	3	Mother died of consumption.
A 1677	24	1	Mother died of consumption.
A 1684	25	2	Mother and brother died of consumption.
A 1685	40	1	Father and mother died of consumption.
A 1686	22	1	Father died of consumption.
A 1687	44	1	Mother died of consumption.
A 1688	32	1	Mother died of consumption, father and sister insane.
A 1693	26	6	Father died of consumption.
A 1695	45	2	Sister died of consumption, aunt insane.
A 1699	19	1	Father died of consumption.
A 1701	25	1	Father and mother died of consumption.
A 1703	23	1	Father and mother died of consumption.
A 1704	32	1	Mother died of cancer.
A 1705	36	1	Two brothers died of consumption.
A 1708	34	1	Mother died of consumption.
A 1712	45	1	Father died of consumption.
A 1713	21	1	Father died of consumption.
A 1715	32	2	Father, three brothers and one sister died of consumption, brother and sister epileptics.
A 1716	52	2	Brother died of consumption.
A 1718	45	1	Father, mother and brother died of consumption.
A 1720	34	1	Father died of consumption.
A 1723	21	1	Sister died of consumption.
A 1724	29	1	Father and mother died of consumption.
A 1725	33	1	Mother and brother died of consumption.
A 1736	25	1	Mother and sister died of consumption.
A 1737	31	1	Mother and brother died of consumption, father died of rum.
A 1738	32	2	Father and mother died of consumption.
A 1739	30	3	Father and mother died of consumption.
A 1741	34	1	Sister died of consumption.
A 1742	29	3	Father died of consumption, mother insane.
A 1743	35	1	Four uncles insane.
A 1752	25	1	Two brothers died of consumption.
A 1757	24	4	Father died of consumption.
A 1759	27	2	Mother died of consumption.
A 1770	32	2	Father and four uncles died of consumption; convict has consumption and impaired intellect.
A 1775	64	5	Father and mother died of consumption.
A 1776	24	1	Father and two brothers died of consumption.
A 1783	53	1	Father and mother died of consumption.
A 1785	72	3	Father died of consumption.
A 1789	24	1	Mother and brother died of consumption.
A 1791	33	1	Father and brother died of consumption.
A 1794	26	2	Father and mother died of consumption.
A 1798	22	2	Brother died of consumption.
A 1799	23	1	Brother died of consumption.
A 1800	25	1	Mother died of consumption.

Convict Number.	Age.	No. of Convictions.	
A 1801	30	2	Mother died of consumption ; convict has consumption.
A 1803	40	2	Father and sister died of consumption ; convict a crank.
A 1805	18	1	Four brothers and one sister died of consumption.
A 1806	23	1	Consumption in family ; convict has consumption.
A 1810	17	1	Mother died of consumption.
A 1811	17	1	Mother died of consumption.
A 1813	38	2	Father, mother, two brothers and one sister died of consumption.
A 1822	28	1	Brother and sister died of consumption.
A 1823	17	2	Father died of consumption.
A 1824	21	2	Father died of consumption.
A 1825	24	6	Father died of consumption.
A 1826	19	1	Father died of consumption ; convict has consumption.
A 1831	32	3	Father and grandfather died of consumption.
A 1832	22	2	Father and mother died of consumption.
A 1837	28	1	Father died of consumption.
A 1841	24	3	Father and brother died of consumption.
A 1845	26	1	Father, mother and brother died of consumption ; convict has consumption.
A 1846	45	1	Brother died of consumption.
A 1850	30	3	Mother died of consumption.
A 1852	21	2	Three uncles died of consumption.
A 1853	27	5	Mother and two sisters died of consumption.
A 1856	46	2	Mother died of consumption.
A 1857	30	1	Father and mother died of consumption.
A 1860	22	1	Father died of consumption.
A 1862	32	1	Mother died of consumption.
A 1863	27	2	Brother died of consumption.
A 1864	21	1	Father died of consumption.
A 1866	35	1	Mother died of consumption.
A 1870	28	2	Father, mother and sister died of consumption.
A 1875	46	1	Sister died of consumption.
A 1878	37	1	Father, mother, two brothers and two sisters died of consumption.
A 1880	26	1	Father died of consumption.
A 1882	21	1	Father, mother, two brothers and two sisters died of consumption ; convict has consumption.
A 1883	35	1	Mother, brother and sister died of consumption.
A 1885	42	1	Father and mother died of consumption.
A 1886	42	1	Father, mother and aunt died of consumption.
A 1888	49	1	Sister died of consumption—only family history known.
A 1889	24	3	Father and mother died of consumption.
A 1891	48	1	Brother and two sisters died of consumption.
A 1892	29	1	Brother and two sisters died of consumption.
A 1897	21	1	Brother and sister died of consumption.
A 1899	26	2	Brother died of consumption—only family history known.
A 1902	33	1	Mother died of consumption.
A 1905	36	2	Father died of consumption.
A 1906	23	1	Father, four brothers and sister died of consumption.
A 1907	18	1	Father and mother drunkards.
A 1913	38	1	Brother died of consumption.
A 1914	25	1	Father died of consumption.
A 1916	23	1	Mother and brother died of consumption.
A 1917	37	1	Father died of consumption.
A 1918	20	1	Father and sister died of consumption.
A 1921	21	1	Mother and two aunts died of consumption.
A 1924	27	3	Sister died of consumption—only family history known.
A 1932	38	1	Father and mother died of consumption.
A 1933	22	1	Mother died of consumption ; convict epileptic.
A 1935	30	6	Father and mother died of consumption.
A 1936	21	1	Mother, brother and sister died of consumption.
A 1937	30	1	Father and brother died of consumption.

Convict Number.	Age.	No. of Convictions.	
A 1938	24	1	Father and mother died of consumption.
A 1940	37	1	Mother, brother and sister died of consumption.
A 1943	28	6	Father died of consumption.
A 1948	20	1	Mother died of consumption.
A 1950	27	1	Father and mother died of consumption.
A 1951	25	1	Mother died of consumption, father died of rum.
A 1953	27	2	Father and mother intemperate.
A 1956	35	4	Brother died of consumption, sister of epilepsy.
A 1959	44	1	Father, mother, sister and three aunts died of consumption.
A 1966	27	3	Father died of rum.

From eight to twelve per cent of the convicts in a State prison will be found to be of this criminal class. In them crime doing is so inherently a dominant factor in their characters, that they never cease the commission of crimes. For the greater part of their lives they may have been subjected to the most efficient and rigorous means known for their reformation, but with practically no effect on their morality. The most prolonged punishments by prison confinement proves equally ineffective in inducing them to lead better lives. Although it is possible for an experienced expert in criminal study to readily recognize in his early history one who will inevitably always be found enrolled among the crime class, it will nevertheless be accepted with less doubt that a man should properly be here classified, if a sufficiently long history can be obtained to practically prove the correctness of so recording him. Only the worst class of criminals and those sentenced to prolonged periods of incarceration are placed in State prisons. A study of the records of a State prison over a period of fifty or sixty years, will show that when a man has three or more times been sent to such a prison, his name thereafter will be repeatedly found enrolled until the end of his life. A selection, in consecutive order, of two hundred convicts who have been three or more times convicted and sent to penitentiaries, and a study of the family health history of each of these respective individuals, demonstrates that $74\frac{6}{10}$ per cent of them have had occur three or more deaths from tubercular consumption in their respective immediate families, within the limit of father, mother, brothers, and sisters. This is certainly remarkable, and would seem to point strongly to the existence of a defective physical make-up as accounting for the abnormally immoral lives of these

people. It would seem that such physical inheritance had also to do with the styles of crime committed by such unfortunate persons. Of 367 convicts who died of consumption in the Eastern State Penitentiary during the past sixty years four $\frac{92}{100}$ ($4\frac{92}{100}$) per cent were convicted of assault and battery, while of the entire criminal population of that period seven $\frac{34}{100}$ ($7\frac{34}{100}$) per cent were convicted of this crime; $\frac{55}{100}$ of one per cent of the convicts who died of consumption were convicted of murder in the first degree, while $\frac{37}{100}$ of one per cent was the proportion convicted of this crime in the total population. In murder in the second degree the respective percentages were $6\frac{1}{100}$ as against $2\frac{46}{100}$; counterfeiting, $1\frac{63}{100}$ as against $3\frac{75}{100}$; embezzlement, $1\frac{91}{100}$ as against $\frac{63}{100}$; horse-stealing, $4\frac{11}{100}$ as against $3\frac{10}{100}$; robbery, $5\frac{74}{100}$ as against $4\frac{21}{100}$; burglary, $23\frac{75}{100}$ as against $14\frac{43}{100}$; larceny of all forms $38\frac{54}{100}$ as against $45\frac{07}{100}$; arson, $4\frac{10}{100}$ as against $2\frac{14}{100}$. Closely noticing these figures shows that in some crimes, such as burglary and arson, the percentage is almost double in the convicts dying of consumption as compared with the percentage found among the entire prison population.

MEMORIAL OF DR. A. Y. P. GARNETT.

ALEXANDER YELVERTON PEYTON GARNETT was born in Essex County, Va., September 19th, 1820, and was the son of Muscoe Garnett and Maria Battile, his wife. Among his ancestry were many of the best known old families of Virginia.

His boyhood was spent at his home, and his education conducted under private tutors without any incident worthy of mention.

He began the study of medicine at the University of Pennsylvania at the age of nineteen, graduating therefrom in 1842, and after passing his examination before the Naval Medical Board was appointed Assistant Surgeon in the Navy. His first cruise was to the Pacific, under Commodore Stribling, on the United States steamer "Cyane;" while on a subsequent cruise he visited South America, and at Rio met the lady who subsequently became his wife, Miss Mary Wise, the daughter of Henry A. Wise, of Virginia, then United States Minister to the Court of Brazil. After his marriage he was stationed temporarily at Washington, but soon resigned his position in the Navy and began his career as a civil practitioner. From the first he was very successful, and throughout his long career he continued to be a popular physician and to gain and hold the friendship and regard of his patients. His success can, in a measure, be attributed to the active interest he took in his profession, his skill as a diagnostician, and to the remarkable attractiveness of his manner.

He was soon elected to the chair of Theory and Practice of Medicine in the National Medical College, which position he filled acceptably.

At the outbreak of the Rebellion his sympathies were warmly enlisted with his native State; he left Washington for Richmond, Va., where he remained until the close of the war. So many of his friends and former patients were in this city that he very soon found himself actively engaged in as large a practice as before his removal.

He was appointed surgeon in the Confederate Army, and placed in charge of two hospitals. He was also a member of

the Board of Medical Examiners to examine applicants for admission to the Medical Corps. These positions he continued to hold during the entire war. He was the physician of General Lee and family, as well as to the families of Generals Joe Johnston, Hampton, Preston, Breckenridge, and of many members of the Confederate Cabinet and Congress.

At the termination of the war in 1865, when Richmond was evacuated, Dr. Garnett, at the request of Jefferson Davis, accompanied him as a member of his personal staff, but after the surrender of Johnston's army he returned to Richmond a paroled prisoner.

He resumed the practice of his profession in Richmond, but in 1865 returned to Washington. Here he immediately found himself engaged in active practice and in lecturing. He was elected to the chair of Clinical Medicine in the Medical Department of Columbian University, which position he held for many years. He also became one of the Board of Directors of the Children's Hospital, and served as President of the Medical Society and of the Medical Association of the District of Columbia.

In 1874 he was chosen President of the Southern Memorial Association of Washington, and selected to deliver the oration upon the occasion of the interring of the dead of Early's army, who had fallen in the attack upon Washington. His address upon that occasion was very appropriate and conciliatory in its tone.

Dr. Garnett was elected President of the American Medical Association, and presided at its meeting in 1886. His address on medical education excited a great deal of notice and approval at the time, as he brought into very broad relief the evils of medical education in this country.

His last public work was in connection with the meeting of the International Medical Congress, held in Washington in 1887. It is well known how many obstacles and difficulties attended the completing of the arrangements for that meeting, and it was only by dint of most arduous labor and untiring energy that Dr. Garnett, as Chairman of the Committee of Arrangements, gave it so large a measure of success. There is no doubt that the anxiety of mind and physical fatigue attendant upon his duties at this time helped to bring on the

failure of health which ended in his sudden death in the summer of 1888.

Dr. Garnett contributed a number of papers to medical journals, which were all of great practical value and interest. The paper which he read at the meeting of this Society, in 1887, entitled "Observations on the Sanitary Advantages of Tide Water Virginia," is a fair example of his thoroughness in the treatment of medical questions.